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The Automobile

Automobile Electricity

Locating and Curing Troubles

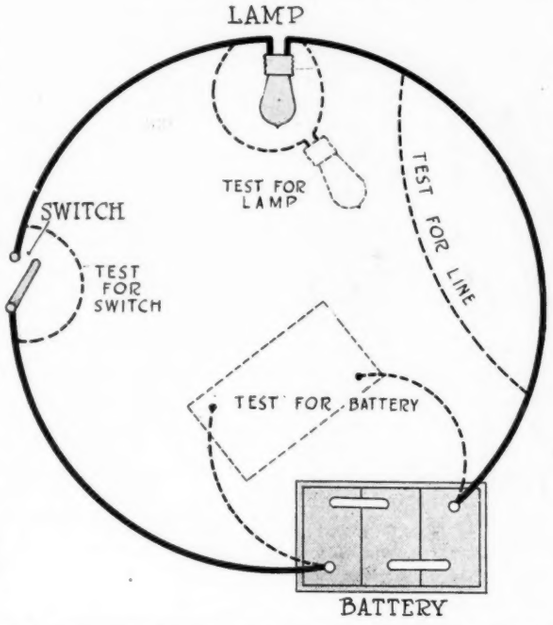
PART I

The Electric Circle and Its Elements—Fundamental Principles of Tracing Faults—Knowledge Necessary Before Taking Steps to Cure Failures

By J. Edward Schipper

THE symbol of continuity is the circle. It begins at any point on its circumference and it ends where it begins. The flowing line which bounds the circle is complete and uninterrupted and must be so or it ceases to be a circle.

This symbol of continuity well expresses the characteristics of an electric circuit. The circle must be complete, for if it is interrupted current ceases to flow in just the same way as the circle ceases to exist as soon as the peripheral line is broken. This picture must be in the mind of anybody thinking of an electric current. He must visualize the complete circle of flow which begins and ends at the same point, or it may even be said which has no beginning and no ending. It is a continuous flow of energy harnessed to do the desired tasks by devices incorporated in the circular chain. No matter how many of these devices there may be or through how many phases of activity the circle of energy may pass, it must necessarily be complete. The electric current and the circle are synonymous.

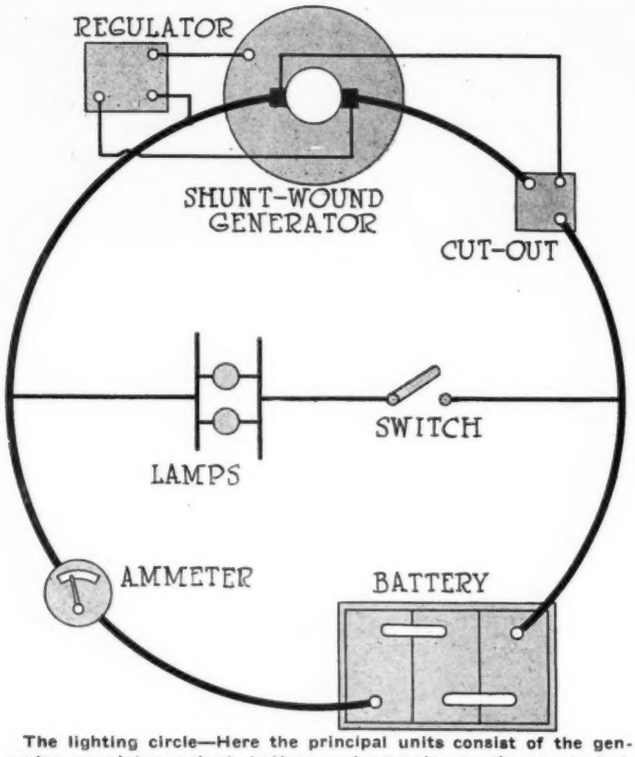


A fundamental electric circle or circuit and how it can be divided into arcs in finding trouble

This series of articles has to do with troubles in automobile electrical systems. These troubles are expressed and are shown by interruptions in the electric circle, call it circuit if you so desire, of which they form a part.

When a civil engineer has a surveying problem to meet he generally solves it by getting at it on three sides. It is possible to take a leaf from his book and use the same method by taking three different viewpoints from which to gain an insight into the finding and remedying of troubles on lighting and starting systems. These three viewpoints are: First, a grasp of the electric circle or circuit, as it is known in technical parlance; second, a method by symptoms in which the interpretation of visible effects of electrical irregularities is given; third, a viewpoint by units in which each individual part of the complete lighting and starting system is taken up separately and the vulnerable points indicated.

In other words to get a true perspective of the entire electrical layout on the car these three fundamental methods of approach must be consciously or unconsciously followed in order that a logical order is maintained and the process of elimination which was pointed out as the true method of search, carried to its conclusion. The broad idea of electrical flow must be first in mind; second, the symptoms which lend a



The lighting circle—Here the principal units consist of the generator, regulator, cutout, battery and ammeter on the great circle and the lamps and switch on the inner arc

helping hand in reducing the necessary area of search and third, a knowledge of the functions of each part in the system and the points at which troubles may occur.

Must Visualize the Circle

To think electrically the mind must travel in a circle. No matter at what point you start, you must travel around the circle and back to that point before you have completely covered the system or part of the system which you are studying. All through the electrical equipment of an automobile, no matter what part is taken, the mind's eye must visualize that complete circle. No electricity will flow unless the circle is complete and as soon as the circle is complete, whether it is completed wittingly or not the current will flow through the circuit.

On the car there are three great electrical circles to bear in mind. These are lighting, starting and ignition circles. In connection with these systems there may be smaller subcircles, but these are all included in these three major circuits. If the mind can visualize each of these and picture it applied practically to the car, the first great step in becoming capable of handling electrical troubles will have been accomplished.

The elementary principle is the same no matter if the circle under consideration contains the most delicate electrical apparatus. If the circle is made up of a battery, a lamp and a switch it is complete and the other additions only widen the circle without altering any of the fundamentals.

The illustration on the first page brings this out clearly. It shows the circle of flow and also shows how piece by piece this circle can be gone over to locate the trouble. If the circle were broken at any point the current could not flow. It is the function of the switch to make and break this circle and by it the electrical circuit is completed or not according to whether the operator wishes the lamp to be out or lit. This circle idea should be borne in mind when studying the laws of current flow.

First Principles of Electricity

No one knows what electricity is, but many of its qualities are so well known that they can be utilized. The laws of current flow, the methods of generation and the manifestations of electrical energy are the three main points which must be grasped before any conception can be had of the main and sub-circles of electrical flow as manifested in starting, lighting and ignition circuits.

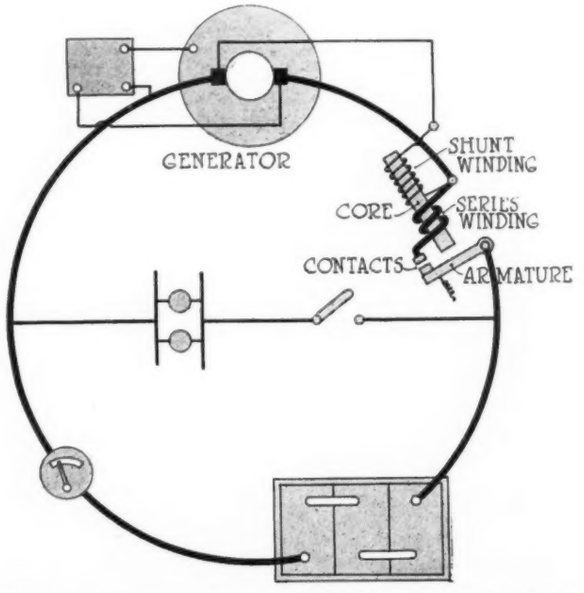
In order to make current flow through an electric circle two conditions are necessary: first, that there is sufficient pressure to force a flow of current around the circle through all the resistances of the line, and secondly, that nowhere on the line is there sufficient resistance to prevent flow. On analysis these two conditions really mean the same thing, that is, that a path is finished for the current and that there is sufficient voltage or pressure to force the current over that path.

Basic Testing Method Explained

This fundamental condition for current flow gives a basic scheme for testing electric circuits. Knowing the cycle of events it is only necessary to apply the process of elimination and to go step by step taking a definite arc of this circle at a time until finally the whole circle has been covered and the weak spot located.

Referring to the simple electrical circle which is described as a battery, switch and lamp with connecting wires, it is possible to see how this simple circle can be divided into a number of smaller arcs when testing for some trouble which causes a total or partial interruption of the current flow. In the first place to know that there was some trouble we would have to have symptoms. These might be shown in a continual leakage of the current from the battery when the switch is not on or they might be shown in a failure of the lamp to light brightly or at all when the switch is turned on. Either of the conditions outlined denotes trouble, and when we set about finding the cause of the trouble we must do so by the process of elimination. Let us say that the lamp does not light when the switch is turned off. Immediately the mind must picture an interruption in the complete circle of current flow from battery to switch, from switch to lamp, from lamp back to battery. This is the external part of the circle and the final connecting link is the internal current from the negative pole to the positive pole within the battery.

One by one we must bridge across these definite arcs of the complete circle to locate the source of trouble. Starting with the most obvious, the lamp, with the switch turned on, we might see if the lamp is tight in its socket. If it is loose



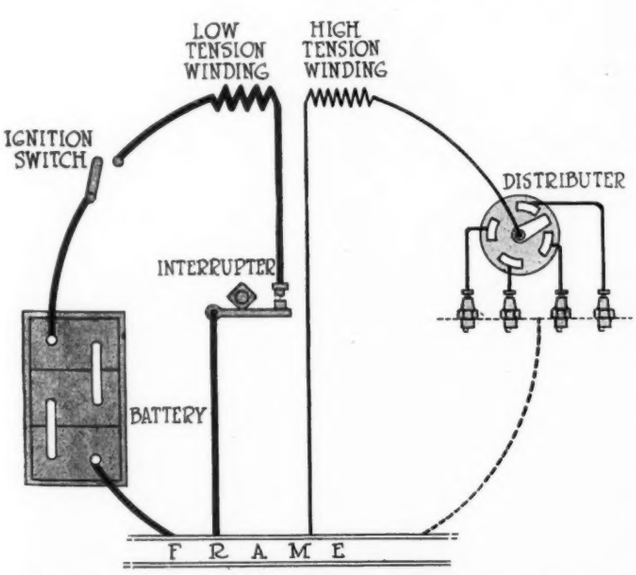
How the circle passes through the cutout unit showing the sub circles which are involved in this particular phase of proper lighting arrangements. The shunt winding is the sub circle while the series winding is a direct part of the main circle

the circle is interrupted here. Next it might be found that the lamp is burnt out. This can be determined by examination of the lamp filament by eye or by the substitution of a known perfect lamp. Then the connections of the wire at the lamp are examined. If these things are all found to be perfect we move to the next point in the circle, the switch. Bridging across the terminals of the switch by another wire cuts off this part of the arc and tells us at once whether or not the trouble is at the switch. Should the lamp light when the switch is bridged it indicates a faulty switch. If bridging the switch indicates no trouble here the next move is to the battery and this part of the arc can be bridged by trying a known perfect battery or by using an electrical measuring instrument on the battery to see if the electrical pressure or voltage of the battery is sufficient to send the current over the line and to light the lamp. Should this test fail there remains going over the wire piece by piece to see that there is no break.

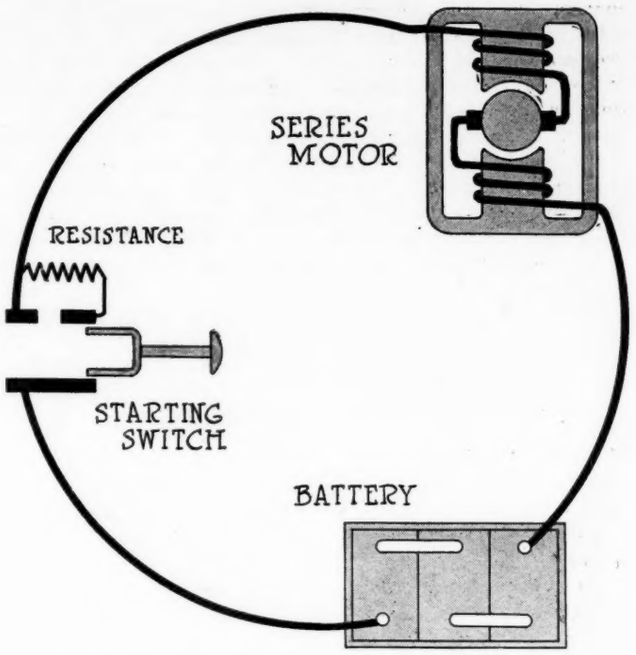
Elementary Principle Applies

In doing this work the most elementary stage of electrical trouble-finding has been accomplished. No matter how complicated the circle may be this original principle applies. The elementary methods may have to give way to more complex systems of testing on complicated electrical installations but nevertheless, the basic scheme must remain. Searching must be done by a process of elimination by gradually working through the entire circle. Of course certain obvious troubles will render unnecessary the complete search, but as soon as this occurs the trouble ceases to be electrical and requires mechanical treatment suggested by the damage. Speaking exactly, there is no such thing as electrical trouble. The imperfection is due to an interruption in the functioning of the electrical units caused by some mechanical fault. Machinery and mechanism may fail but electricity, that hidden form of energy of which no one knows the exact definition, will never fail provided the mechanical paths or circles are kept intact to allow it to perform its work.

Having grasped the elementary law of electrical current flow and the fundamental principle of searching for interruptions in electrical apparatus, the next step is to see how these rules are applied to the great circles of automobile electrical mechanism. Starting, lighting and ignition are these three circles. They can be taken independently, for although on many installations units of one will be units also of the other, still in each case the complete circle exists.



The ignition circle is made up of two parts, low tension and high tension. Nevertheless, the complete circuit idea is clearly shown as each part must be complete before the functions are correct



A simple circle is that of the starting motor. Here the current flows from battery to switch, then to the motor and back to the battery again. Often times there is a sub circle for the starting pinion engagement when this is accomplished magnetically

Simplest of all is the starting circle. Current flows from the positive side of the battery, through the wire to the motor terminal, then through the field winding passing on to the armature winding, then to the switch and back to the negative side of the battery completing the circle.

Study of the Starting Circle

Another part of this article will be devoted to symptoms of trouble. Let it be assumed that it is known that trouble lies in the starting circle. The question becomes how is it possible to apply the basic principle of testing to this more complicated circle? It can be done readily simply by following out the system of process of elimination which has already been stated to be the universal method in finding trouble.

Let the arcs into which the circle is divided be: First, the battery; second, the starting switch; third, the starting motor and fourth, the wires and connections. Let us take for our means of testing a simple test lamp consisting of an ordinary 6-volt bulb with a couple of leads, assuming this system to be a simple 6-volt arrangement. The first arc we have taken is the battery. Placing the ends of the testing lamp wire across the positive and negative poles if the lamp burns brightly it is quite evident that the battery is giving its 6 volts pressure. Remove the negative wire from the battery and put one of the test lamp terminals in contact with the negative pole of the battery and the other terminal of the lamp in contact with the end of the detached negative wire. If there is a short circuit in the system the lamp will light. In case it is a single-wire system instead of touching the terminal of the test lamp to the negative wire it will go to the car frame instead, and hereinafter when the negative wire is spoken of it will mean the car frame on single wire or grounded return systems.

The next arc of the starting circle is the switch. It is not always possible to simply bridge across the switch with a heavy piece of cable because the switch generally incorporates a number of features for the engagement of the pinion of the starting motor, etc. Therefore, it will probably be neces-

sary to take the cover from the switch and examine it carefully, tracing the wiring and seeing that none of the parts are fused or burnt away and that all connections are firm and solid. If the switch is of the two-point type in which the first point of engagement causes the current to flow through a resistance allowing the starting motor to turn slowly while the pinion engages with the flywheel it will be possible to bridge first across the resistance and then across the entire switch. If the motor runs properly and cranks the gasoline engine when this is done the trouble is in the switch and this can be taken off and examined and the trouble corrected. If the starting switch blades do not make contact or the switch terminals are loose this can generally be found from inspection. A grounded or short-circuited starting switch will often be not so easy to locate and the insulation of this part of the circuit should be gone into very carefully before passing on to the next part of the arc.

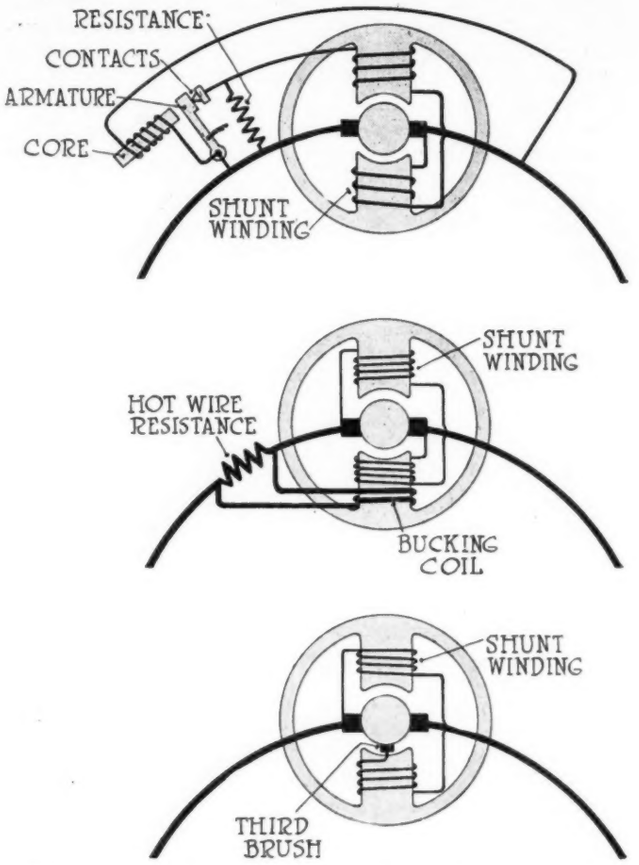
Checking the Starting Motor

After examining all the wiring and connections in the starting circle, it is necessary to come finally to the starting motor itself. The course of the windings through these motors is always the same since they are all series-wound. Current passes from the battery to one of the terminals of the motor which is connected with the winding around the magnetic field. The current passes through this field winding and thence to the commutator of the motor where it is led to the armature winding. The current passes through the armature from one brush to the other and thence back to the battery. There are only certain parts of the starting motor that are susceptible to repairs by any except the factory. The armature is rendered practically impregnable in the insulation process and cannot be generally torn down and rewound. The same applies to the field windings. The commutator, brushes, brush holders, external leads, brush pigtails as the wires to the brushes are called, and other external parts which are accessible by removing the commutator housing are generally susceptible to repair by people with a limited amount of electrical equipment or skill.

The lighting circuit is made up of two circles, one bounded by the battery lamps and control switches with the connecting wires and the other from the generator to the battery including the cutout relay mechanism, the fuse connections and the regulator.

Circle Not Always Plain

The battery lamp circuit on the whole is about the simplest electrical circle on the car. Leaving the positive terminal of the battery the current passes through an ammeter, then to the lighting switch from where wires lead to all the lamps and back to the negative side of the battery. Regardless of how the lamps are connected, whether in series or parallel, each one is a simple part of this circle. Should one lamp go out and the others act perfectly local troubles are certain to be the cause. If the circle is broken as a whole all the lights will go out and it then becomes a matter of searching for the break. Piece by piece this circle can be divided into small arcs and one by one they can be searched for the trouble. It is almost a parallel with the elementary battery switch and lamp circle first described except that here we have an ammeter and several lamps in addition. The battery can be tested with the test lamp across the terminals. The ammeter can be tested by bridging around it with a connecting wire. The switch can also be bridged as can the main leaves to the lamps and the connections to battery and other terminals. Once the trouble is located in such a definite locality as the switch, ammeter or terminal connection it can be definitely determined and the suggested remedy applied. While the battery lamp circle in itself is simple it will be oftentimes puzzling or even impossible for the layman to visualize this circle actually on the car. Some of the wiring



The regulator sub circle varies in its arrangement. Here are three typical regulation methods, top the vibrator type; center, hot wire resistance; bottom, the third brush method

systems carry the wires of this circle through such a course that it would be impossible to follow it and therefore it is necessary for the person working with any car to have a knowledge of its wiring diagram. This should be secured before experimenting with the wires.

An instance of this is in a given two-wire system where the battery lamp circuit takes the following course. The positive battery lead runs directly to the starting motor field. From this lead is led the wire to the ammeter. Leaving the ammeter the course of the current is then through the lamps, then through the lighting switches passing through the series field winding of the armature and back to the motor starting switch where contact is made with the negative lead of the battery completing the circuit. This does not sound like the simple battery lamp circle and yet in effect that is all it amounts to.

The other lighting circle includes the generator. It also includes the delicate and ingenious schemes of regulation and contact breaking. Starting on the positive brush of the generator the current flows through the contact breaker and then to the positive lead of the battery. Passing through the battery the course of the current is then through the ammeter and back again to the generator. In the path of this current somewhere in the circle is inserted the regulating means. The position of this depends on the method chosen. Another circle within this greater circle is the means for exciting the generator field. Regardless of what method of regulation and what method of field excitation is used the law of continuity as expressed by the circle exists, and this circle also can be divided into smaller arcs in tracing down the troubles which are apt to occur.

Having incorporated in this circle an ammeter a great amount of assistance is given in determining where to look

for the trouble. The ammeter indicates at once if current is flowing from the battery and should this be so with the switches off it immediately suggests a short or ground. Taking up the step by step bridging process a start is made as usual from the battery. The test lamp will show if this is in proper condition to light the lamps. An examination of the terminal connection will show if these are tight. If there is a breakdown in the ammeter, wire can be bridged around it immediately indicating if this is true. Coming to the generator it is a matter of going step by step over the commutator, brushes, brush holders, springs, brush connections or pigtails. Mechanical troubles of course will enter into the reckoning and a seized armature or worn or broken down armature shaft bearings must be looked for. There is very little that can be said about the wiring of the generator as when the winding is impregnated with insulating compound and baked it becomes as hard as a mass of rock. Coming to the contact breaker this can be bridged across and if generator does not charge as indicated on the ammeter it is possible to connect around the circuit breaker momentarily to see if there is a failure of operation here. The connection around the circuit breaker need not be an actual wire connection but generally only amounts to pressing the contact points together with the finger and observing if the ammeter indicates charge when the engine is running at a speed above the charging rate. Theoretically it is the same as the basic principle of testing as first laid down with the battery switch and lamp.

The ignition circuit can be tested by applying the same principle. It is only a matter of systematic step-by-step trying in using the process of elimination to get to the source of trouble. This series deals with starting and lighting but the elementary principles it brings up are applicable to all electric circuits.

Trouble Hunting Notes

In testing the battery it is well to determine if the troubles are distributed throughout the entire battery or confined to one or more cells. The bridging method of testing can be applied to the battery in order to determine this. A small voltmeter is handy as this can be placed across each cell to indicate if it is giving the 2 volts pressure that is required. One of the first places to look for trouble is in the battery electrolyte. This should be kept up to the proper level by adding distilled water frequently so that the plates are covered. The battery in which the plates are not fully covered by the electrolyte has a decreased capacity due to the fact that the active material in the upper parts of the plates becomes hardened and unfit for use. Another point to observe is the specific gravity of the electrolyte which should be between 1.275 and 1.300 when the battery is fully charged. A battery should never be discharged lower than 1.150. The instrument for making these tests is the hydrometer or hydrometer syringe which is especially adapted for storage battery testing. Keeping the electrolyte in proper condition is about all the car owner can do beyond keeping the battery clean without acid on the outside as more complicated repairs require equipment which is only in the hands of battery manufacturers.

When troubles occur, before more serious or complicated parts are disassembled examine the wiring. Two things are necessary in going over the wiring of the car. First a knowledge of the wiring diagram, and second, the application of the elementary testing principle of bridging the trouble. There is always the possibility that in the original wiring of the car an error has been made and therefore when the circumstances seem baffling it is wise to check the wiring of the car against the wiring diagram. The electric circle must always be complete and loose connections or short circuits which interrupt it must be found by going over the wire step by step.

Improper adjustment of the regulator is an example of an electrical trouble which will not be found by the primary bridging method. It is to locate such irregularities as these that the ammeter is placed on the car, or if an ammeter is not used some form of current indicator with the words Charge and Discharge in place of the indicating needle. The driver should know at what speed the battery becomes connected to the generator by the cut-in mechanism and if this does not occur until the speed is too high the battery will not receive sufficient charge in many instances to carry the lamp and starting load as it should. In many instances not every repairman is authorized to adjust the regulator and for this reason it is necessary to take the car to the service station of the starting and lighting company that has made the installation.

Some Extraordinary Conditions

There are other troubles which will not be located by the ordinary bridging method and these are particularly in and around the commutator assemblies. All generators and motors, however, are arranged to have the commutators accessible by the removal of a cover plate and all that is necessary in searching for trouble here is to know the mechanical conditions which should obtain. These are namely, a clean commutator with the mica between the segments undercut so as not to interfere with the contact of the brushes, a good brush contact given by proper spring pressure by a proper fit of the brush in its holder and by a proper engaging surface of the brush and perfect pigtail or brush wire connections. All of these can be determined by inspection.

One word of caution which cannot be expressed too strongly is not to be satisfied after having found the actual manifestation of the trouble because this may be the effect and not the cause. Until the cause is removed the effect will be bound to recur with the annoyance of having an interruption of service and a consequent expense and loss of time.

To put this in another way the circumstances which are causing the trouble may not be in the place where the manifestations of trouble are noted. One or two examples to illustrate this point will give a clear view of what is meant. A man drives his car into the repair shop with a stripped ring gear on his flywheel. Evidently nothing else is wrong. The repairman simply performing the obvious renews the ring gear, the car starts satisfactorily and the owner drives away. In a few days he returns with another stripped gear. The point is that when the repairman renewed the gear he only remedied the effects of the trouble but did not cure the cause, which was in a faulty starting switch which did not always make contact with the resistance circuit giving a slow movement of the armature of the starting motor before it went into full engagement and secured the full torque of the starting motor.

Examine Entire Circuit

No one would say that when a fuse blows or melts that the trouble is in the fuse. Before replacing the fuse it is well to look for the trouble on the circuit in which the fuse is connected. The test lamp can be employed to great advantage in doing this. For instance, if the blown fuse is in one of the lamp circuits the lighting switch can be turned so that all the lamps should light. The test lamp terminals should be put on each of the fuse clips and if the lamp lights the ground trouble is still there. Connect the test lamp to the negative wire of the battery and then with the other side go over it piece by piece until the lighting lamp indicates the position of the ground or at least what parts of the circuit are grounded. In each step that is taken remember the electric circle and bridge it arc by arc until the whole system has been covered.

(To be continued)

Cheapening Cars by Reducing Varieties

A Scheme for Cutting Cost by Establishing Standard Engine Dimensions, Etc.—A Speculation of Standardization's Possibilities

By William Kent

IN THE AUTOMOBILE for Dec. 30, 1915, appeared a complete list of specifications of the 1916 cars, with their sizes and prices. They are divisible into four classes, viz.: two-, three- and four-passenger, five-passenger, seven-passenger and closed cars. The list shows a most confusing variety in size of cylinder, length of wheelbase and price.

During the experimental stage of the automobile industry such a variety was to be expected, for designers had no precedents to guide them, and it was necessary to try out a great number of proportions before standards could be determined upon. The time has now arrived, however, when the multiplicity of sizes and proportions can be considered only as a great economic waste, causing unnecessary duplication of the work of designers, draftsmen and pattern makers, and in the case of all except the largest manufacturers, a high manufacturing cost.

From the lists given, I have selected the list of the five-passenger cars as an example, and have subdivided it into four-, six-, eight- and twelve-cylinder cars, as in the accompanying Table 1. The table shows that on the average the price of a car bears some relation to the size, but individual cars of one size show extraordinary variations in price. Thus, of four-cylinder 22.5-hp. cars, the range of prices is from $440 to $2,700, and of six-cylinder 38.4-hp. cars the range is from $1,095 to $4,300. Of course, the size of an automobile is only one of the factors in its prime cost. Other important factors are quality of material, workmanship, finish, upholstering, size of tires and miscellaneous accessory equipment. The prime, or factory cost also is only one of the factors of the selling price, the margin between the two depending on the selling policy, the cost of making sales, including in many cases expensive advertising, the commissions or profits of dealers, and the manufacturer's profit per car.

High Price Causes High Cost

As a general rule, a high selling price is a cause of high factory cost, for it limits the volume of business and thus increases the overhead factory expense per car, which decreases as the volume of business increases.

Table 1 shows that seventy-seven makers are producing 103 styles of five-passenger cars, ranging from 13.2 to 60 hp. and 100 to 147-in. wheelbase, and priced from $440 to $5,900. As regards size, it would seem reasonable that ten or twelve different sizes would cover all the possible needs of the users of the cars, but the manufacturers are furnishing no less than forty-five different proportions of cylinders, including twenty different diameters from 2⅞ to 5⅛ in. and fourteen lengths of stroke from 3½ to 7 in.; thirty-three different horsepowers from 13.2 to 60, and twenty-eight different lengths of wheelbase from 100 to 147 in.

Table 2 is an attempt to show the relation of the selling price to the size of a car, arbitrarily taking the "size" as the sum of the horsepower and the wheelbase. By dividing the total range of this so-called size, from 115 to 207, into seven classes, and taking the average price for each class—after omitting from one to three cars in each class which appear to have fancy prices—we discover that, with the exception of the ten smaller and the four larger cars, the average price varies approximately as the cube of the size. The formula representing the relation of price to size is

$$\text{Price} = [0.01\ (\text{hp.} + \text{w.b.})]^3 \times \text{C.}$$

For eighty out of 102 cars averaged the value of C ranges from 354 to

Table 1—Sizes and Prices of Five-Passenger Touring Cars

Four-Cylinder Cars

Dia., in.	St'ke, in.	Name	Price	H.P.	Wheel Base, in.
2⅞	4	Sterling	$550	13.2	102
3⅛	4	Argo	495	15.6	103
3⅛	5	Overland	615	15.6	104
3⅛	4½	New Era	660	15.6	104
3¼	5	Dort	665	16.9	105
3¼	5	Moore	660	16.9	106
3¼	5	Arbenz	675	16.9	108
3¼	5	Coey Flyer	740	16.9	106
3 7/16	5⅛	Briscoe	750	18.9	114
3½	4	Regal	650	19.6	106
3½	5	Partin-Palmer	675	19.6	110
3½	5	Crow-Elkhart	725	19.6	112
3½	5	Bell	775	19.6	112
3½	5	Elcar	775	19.6	114
3½	5	Inter-State	850	19.6	110
3½	5	Farmack	855	19.6	112
3½	5	Jackson	985	19.6	112
3½	5	Oakland	1,050	19.6	112
3½	5	Oldsmobile	1,095	19.6	120
3⅝	4½	Maxwell	655	21.0	102
3 11/16	4	Chevrolet	490	21.8	102
3¾	4	Ford	440	22.5	100
3¾	4¼	Mecca	695	22.5	104
3¾	4¼	Pullman	740	22.5	114
3¾	4¼	Monitor	795	22.5	108
3¾	4¼	Detroiter	985	22.5	112
3¾	5	Regal	985	22.5	115
3¾	5	Dispatch	1,000	22.5	120
3¾	5	Moline-Knight	1,375	22.5	118
3¾	5⅛	Jeffery	1,000	22.5	116
3¾	5½	Hupmobile	1,085	22.5	119
3¾	5⅝	Stearns	1,395	22.5	119
3¾	5⅝	Biddle	1,800	22.5	120
3¾	5¼	White	2,700	22.5	115
3⅞	4	Metz	600	24.0	108
3⅞	4½	Dodge	785	24.0	110
3⅞	5	Empire	935	24.0	116
3⅞	5	Auburn	985	24.0	114
3⅞	5⅜	Lexington	1,375	24.0	115
3⅞	5½	Kissel	1,250	24.0	115
4	4½	Herff-Brooks	885	25.6	110
4	4½	Richmond	885	25.6	110
4	6	Moline-Knight	2,500	25.6	128
4⅛	4½	Reo	875	27.2	115
4⅛	4½	Willys-Knight	1,095	27.2	114
4¼	5½	Spaulding	750	28.9	120
4⅝	5	Morse	3,600	34.2	127
4¾	5½	Stutz	2,550	36.1	130
5⅛	6¾	Fiat	4,850	42.0	128

Six-Cylinder Cars

2 13/16	4¾	Oakland	795	19.0	110
2⅞	4½	Saxon	815	19.8	112
3	4¼	Grant	795	21.6	112
3	4¼	Elgin	845	21.6	114
3	5	Sun	...	21.6	116
3	5	Cameron	1,000	21.6	122
3	5	Auburn	1,050	21.6	120
3	5	Madison	1,085	21.6	120
3	5	Marion	1,090	21.6	120
3	5	Paige	1,095	21.6	112
3	5	Glide	1,095	21.6	119
3	5	Pilot	1,100	21.6	119
3	5	Jeffery	1,350	21.6	122
3	5	Halliday	1,385	21.6	122
3⅛	5	Monitor	895	23.4	115
3¼	4½	Buick	1,020	25.3	115
3¼	4½	Paterson	985	25.3	117
3¼	4½	Chalmers	1,050	25.3	115
3¼	4½	Velie	1,065	25.3	115
3¼	4½	Kline	1,095	25.3	120
3¼	4½	Empire	1,095	25.3	120
3¼	4½	Moon	1,195	25.3	118
3¼	4½	Westcott	1,395	25.3	120
3½	5	Mitchell	1,250	29.4	125
3½	5	Haynes	1,385	29.4	121
3½	5⅛	Apperson	1,485	29.4	122
3½	5⅛	Lenox	1,985	29.4	128
3½	5¼	Velie	1,400	29.4	124
3½	5¼	Pathfinder	1,695	29.4	122
3⅝	4	Franklin	1,950	31.5	120
3⅝	5½	Kissel	1,250	31.5	126
3¾	5¼	Marmon	2,900	33.7	136
3¾	5½	National Newport	2,375	33.7	134
4	4½	Richmond	1,095	38.4	120
4	4½	Herff-Brooks	1,095	38.4	120
4	5½	Standard	2,100	38.4	126
4	5½	Chalmers	2,175	38.4	132
4	5½	Pierce-Arrow	4,300	38.4	134
4	6	McFarlan	2,680	38.4	132
4⅜	6	Fiat	5,350	46.6	135
4½	5½	Pierce-Arrow	4,900	48.6	142
5	7	Pierce-Arrow	5,900	60	147½

Eight-Cylinder Cars

2⅞	4¾	Jackson	1,195	26.4	112
2⅞	4¾	Oldsmobile	1,295	26.4	120
2⅞	5	King	1,150	26.4	113
3	4½	Regal	1,200	28.8	115
3	4½	Ross	1,350	28.8	115
3	5	King	1,350	28.8	120
3	5⅛	Mitchell	1,450	28.8	125
3⅛	5⅛	Cadillac	2,080	31.2	122
3¼	5	Daniels	2,350	33.8	127

Twelve-Cylinder Cars

2⅝	3½	Enger	1,095	33.1	115
3	5	Packard	2,750	43.2	125
3	5	Packard	3,150	43.2	135

429, generally increasing as the size increases.

For the ten small cars the average value of C is only 338, and for the four large cars it rises suddenly to 702.

If there were a uniform demand for all sizes of cars it would reasonably be expected that the factory cost of cars would vary, not as the cube of the size, but approximately as the square; but the fact is that there is an enormous demand for small cars, which tends to reduce both the factory cost and the cost of selling these cars, and a small demand for the large cars which increases their factory cost and greatly increases the cost of selling them. Hence the result that the price of the large car increases more rapidly than the cube of the size does not seem to be unreasonable.

Taking the Ford car, the smallest and also the lowest priced car on the list and the one for which there is the greatest demand, and applying the formula to it, we find the value of C is only 242. The low price of this car, together with its excellent quality, causes the great demand for it, reduces the expense of selling it, warrants the investment of a great amount of capital in its manufacture and the use of the best machinery in making it, making possible the smallest labor cost together with the highest wages to workmen, and produces the largest annual profit.

One of the causes which makes it possible to sell the Ford car at its low price is the fact that only one size of car is made. If the Ford factory, with its present size and its present capital, should undertake to make half a dozen different sizes of car, ranging from 22 to 60 hp., it is safe to say that the profits of the business would be greatly reduced, and that the factory cost of the present car would be increased. But if Mr. Ford or a combination of makers should with increased capital undertake to meet the demand for different sized cars from 22 to 60 hp., it is certain that not more than six or eight different sizes of cylinders would be selected within that range, instead of the forty-five different sizes that are now made by the seventy-seven makers.

Of the forty-three six-cylinder cars in Table 1, thirty are found with only six diameters of cylinder, viz.: ten 3 by 5, 21.6 hp.; five 3¼ by 4½, 25.3 hp.; six 3½ by 5 to 5¼, 29.4 hp.; three 3¾ by 5 to 5½, 33.7 hp.; and six 4 by 4½ to 6, 38.4 hp., while the other thirteen are all of different sizes, including seven different diameters of cylinder. If the makers of say ten out of these thirteen cars were to abandon their present exceptional sizes of cylinder and adopt one or other of the five sizes of the thirty cars, it would be possible for numerous economies in factory costs to be effected and considerable reduction in selling price to be made, with consequent increase of business and annual profits.. With standardization of sizes of cylinders would come standardization of pistons, piston rings, connecting-rods, crankshafts and their bearings, springs and other parts of the machine.

Possible Standard Sizes

Table 3 is a tentative list of standard sizes, thirteen in all, with five diameters of cylinders. The average price is figured from the formula, with the values of C for different sizes taken approximately as those given in Table 2, rejecting those of extreme price. Figures are

Table 2

Classification of Cars Into Seven Groups According to Suggested Formula for Size Determination. ("Size" = Horsepower + Wheelbase)

Size 115 to 125

Size	Price	No. of Cyls.
122	$440	4
124	490	4
119	495	4
115	550	4
120	615	4
122	665	4
120	660	4
123	660	4
125	675	4
123	740	4
Av. 121	$599	

Size 126 to 135

132	$600	4
126	650	4
132	655	4
130	675	4
126	695	4
132	725	4
133	750	4
132	775	4
134	775	6
130	795	4
129	795	6
134	795	6
132	815	6
130	850	4
135	875	4
132	985	4
132	985	4
134	985	4
132	1,050	4
134	1,095	4
Av. 132	$815	

Size 136 to 145

Size	Price	No. of Cyls.
136	$740	4
136	845	6
136	885	4
136	885	4
138	895	6
140	935	4
137	985	4
138	985	4
142	985	6
138	1,000	4
144	1,000	6
142	1,000	4
140	1,020	6
142	1,050	6
140	1,050	6
140	1,065	6
141	1,085	4
142	1,085	6
142	1,090	6
140	1,095	4
141	1,095	4
141	1,095	6
145	1,095	6
145	1,095	6
141	1,100	6
139	1,150	8
143	1,195	6
138	1,195	8
144	1,200	8
139	1,250	4
144	1,250	6
144	1,360	8
144	1,360	6
140	1,375	4
139	1,375	4
144	1,385	6
141	1,395	4
145	1,395	6
142	1,800	4
142	2,500	4
137	2,700	4
Av. 140	$1,190	
Av. omitting last three,	$1,102	

Size 146 to 155

Size	Price	No. of Cyls.
149	$750	4
148	1,095	12
154	1,450	8
149	1,350	8
150	1,385	6
151	1,400	6
146	1,295	8
153	1,485	6
151	1,695	6
151	1,950	6
153	2,080	8
Av. 150	$1,449	

Size 156 to 165

158	1,095	6
158	1,095	6
157	1,250	6
157	1,985	6
164	2,100	6
161	2,350	8
161	3,600	4
Av. 159	$1,925	
Av. omitting last one,	$1,646	

Size 166 to 175

170	$2,175	6
168	2,375	6
166	2,550	4
170	2,680	6
168	2,750	12
170	2,900	6
172	4,300	6
170	4,850	4
Av. 169	$3,072	
Av. omitting last two,	$2,572	

Size 178 to 207

178	$3,150	12
191	4,900	6
182	5,350	6
207	5,900	6
Av. 190	$4,825	

Formula for Average Price. $\text{Price} = \left(\frac{\text{HP.} + \text{W.B.}}{100}\right)^3 \times \text{C}$. Prices and Values of the Constant C

No. of Cars Averaged	Av. Size HP. + W.B.	Av. Price	$\left(\frac{\text{HP.} + \text{W.B.}}{100}\right)^3$	C
10	121	$599	1.771	338
21	132	815	2.300	354
41	140	1,102	2.744	402
11	150	1,449	3.375	429
7	159	1,646	4.020	409
8	169	2,572	4.827	533
4	190	4,825	6.859	702
102				

Ford car, 3¾ by 4 in., four-cylinder, 22.5 hp., wheelbase 100 in. $\left(\frac{\text{HP.} + \text{W.B.}}{100}\right)^3 = 1.84$. Factor for price $\frac{440}{1.84} = 240$, or 28 per cent below the average factor for ten small sized cars given in the table.

Table 3—Proposed Standard Sizes of Automobiles

(5 passenger)

Diameter of cylinder, in.	....	3	3½	4	4½	5
Length of stroke, in.	....	4	4	5	5	5
Or	....	5	5	6	6	6
Horsepower	4 cyl.	...	19.6	25.6	32.4	40
	6 cyl.	21.6	29.4	38.4	48.6	60
	8 cyl.	28.8	39.2	51.2	...	..
	12 cyl.	43.2	...	...	...	..
Wheelbase, in.	4 cyl.	...	110	120	130	140
	6 cyl.	115	120	130	140	145
	8 cyl.	120	130	140	...	...
	12 cyl.	128	...	...	...	...
Sum of horsepower and wheelbase	4 cyl.	...	130	146	162	180
	6 cyl.	136	149	168	199	205
	8 cyl.	149	164	191	...	...
	12 cyl.	171	...	...	...	...
$\left(\frac{\text{HP.} + \text{W.B}}{100} = \text{S}\right)^3$	4 cyl.	...	2.20	3.11	4.25	5.83
	6 cyl.	2.52	3.31	4.74	7.88	8.62
	8 cyl.	3.31	4.41	6.97	...	...
	12 cyl.	5.00	...	...	...	...
Factor C for Average Price	4 cyl.	...	350	425	475	550
	6 cyl.	400	450	480	?	?
	8 cyl.	480	480	?	...	...
	12 cyl.	480	...	...	...	...
Average Price	4 cyl.	....	770	1322	2019	3207
	6 cyl.	1008	1490	2275	?	?
	8 cyl.	1589	2117	?	....	....
	12 cyl.	2400	....	....	....	....
Low price 30 per cent below av.	4 cyl.	....	539	925	1403	2244
	6 cyl.	706	1043	1593	?	?
	8 cyl.	1043	1473	?	....	....
	12 cyl.	1680	....	....	....	....
High price 30 per cent above av.	4 cyl.	....	1001	1719	2625	4168
	6 cyl.	1310	1937	3957	?	?
	8 cyl.	1937	2752	?	....	....
	12 cyl.	3120	....	....	....	....

also given for low-priced cars 30 per cent below average, and for high-priced cars 30 per cent above average. Low price and high price have no necessary relation to either the quality of the car or to the profit per car, to either the manufacturer or the dealer. If the price of a certain car is $1,000, cutting its price to $700 may increase its sales so that $100 per car may be saved in selling expense, $100 in factory cost and $100 per car taken from manufacturers' profits without reducing the annual profits of either the manufacturer or dealer.

A similar car may sell for $1,300, with a reduction in the number of sales, an increase of $100 in the selling cost, $100 in factory cost and $100 in manufacturers' profit per car, but with no increase in annual profits. The difference between the low-priced car and the high-priced car is $600, but the high-priced car may not be any more profitable as regards annual profits than the low-priced car.

The great reduction in selling prices of automobiles during the last two years has surely not yet reached its limit.

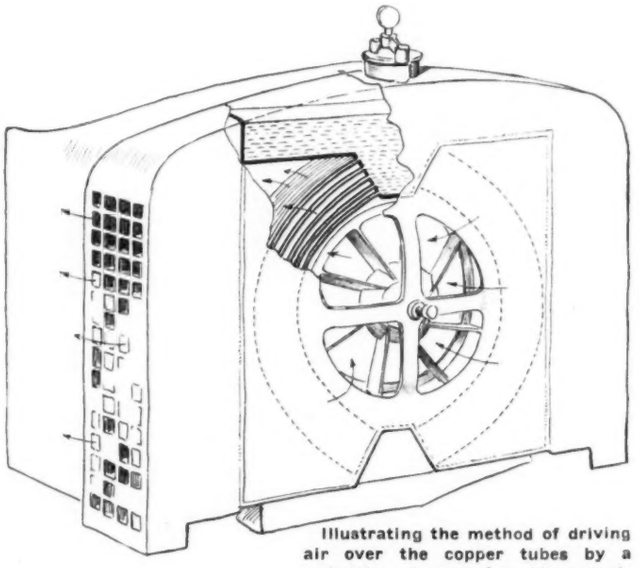
Solderless Radiator Used in Mack AC Trucks

THE radiator used on the Mack model AC trucks is a new design. By the use of a large number of practically semicircular sections of copper tubes, which are expanded into plates that in turn are bolted to top and bottom headers, a solderless radiator is obtained, which expands within itself and withstands severe vibration without failure.

Both top and bottom headers are of aluminum alloy and the upper header forms part of the cowl, while the lower is part of the frame that supports the radiator. The tubes are expanded into the end plates and no solder is used in the construction. As each tube is a unit in itself, one or more of the tubes can be blocked or pinched off in case of emergency without interfering with the others.

Front view of new radiator used on Mack AC trucks

Instead of being placed in front of the engine the new radiator is installed back of it, and a centrally located fan draws air from the driver's cab as well as the motor compartment, and discharges it at the sides. Thus a constant stream of cool air is passed over the radiator tubes, and, as screens are provided on each side of the hood, cool air is also drawn past the engine.



Illustrating the method of driving air over the copper tubes by a radial fan. Arrows show air currents

Freezing Leaves Tubes Uninjured

An illustration of the way tubes of this radiator will stand expansion and contraction without leakage is shown in the case of an AC truck that was left standing outdoors on a very cold day. The water in the radiator was frozen solid, and so great was the strain upon thawing that the lower section of the bottom header burst, yet the tubes remained in perfect condition. Replacing the broken header was an easy matter. The bolts were removed from the two plates holding the tubes, after which the header was unbolted from the chassis and a new one bolted in its place.

Testing Aeroplane Motors with a Fan Dynamometer

When Testing Air-Cooled Types Allowance Must Be Made for Temperature of Air in Which Blades Rotate—If Apparatus Is Correctly Designed and Installed Results Should Be Accurate

By Lawrence Hodgson, B. Sc., A. M. Inst. C. E.

From a Paper Presented Before the Institution of Automobile Engineers

DURING the past year the author wished to use the fan brake dynamometer for accurately determining the horse-power developed by aviation engines. He had available an apparatus which he had designed for testing small propellers in water, and he decided to use this apparatus in order to obtain a better general view of the laws of resistance of fan brakes than could be obtained from the paper above referred to. All tests were carried out with the fan rotating in water, with the exception of one check test (marked A, Fig. 1) which was taken with the fan rotating in air.

In the water tests, the vertical spindle carrying the fan was rotated in a covered tank of still water, 20 ft. square and 5 ft. deep. The blades used were ½ in., 1 in., and 2 in. square, and ½ in., 1 in., and 2 in. in diameter. They were cut from smooth German silver sheet 0.012 in. thick, and the edges were left sharp and at 90 degrees to the face of the blades. The fan spindle was driven by a small air turbine attached directly to it, and the driving torque measured by means of a manometer which indicated the pressure at the turbine jet. The relation between the driving torque and the readings of the manometer was determined by a series of brake tests taken at various jet pressures and turbine speeds. The plane of the fan arms was 10 in. below the surface of the water, the coefficient of resistance having been found to be constant for the largest diameter of fan used for all depths of immersion greater than 6 in. The apparatus and the observer were carried on a platform which bridged the tank. In every case, before a reading of the speed of rotation was taken, the fan was rotated under constant torque until there was no further increase in the speed. The speed of rotation was measured by timing the revolutions of a slow-moving wheel geared to the fan spindle. The temperature of the water during the experiments was approximately 50° F.

Analyzing the Tests

In analysing the results, it was assumed that for geometrically similar fans, the resisting torque due to the blades alone varied as the fifth power of the linear dimensions, as the square of the revolutions, and as the density of the fluid in which the fan rotated. It was further assumed that the coefficient of resistance, κ, would be different for fans which were not geometrically similar. For the square and round-bladed fans which the author used in his experiments, the proportions of the fan were specified by the ratio r/s, and the values of κ in the equation

$$\mu_b = \kappa N^2 r^3 s^2 W \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

were therefore determined for various values of this ratio for each shape of blade. A separate series of tests established the fact that the torque due to the arms alone (μ_a) was given with sufficient accuracy by the formula

$$\mu_a = 0.35 \times 10^{-4} \sigma N^2 r_a^4 t W \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

In order to increase the accuracy of the measurement of the torque due to the blades alone, when r/s was large, μ_a was made as small as possible by using arms of steam-line form. The outside radius, r, was used in Equation (1) in preference to any other linear dimension which varied with the diameter of the fan, such as the radius of the centre of pressure or of the centre of gravity of the blades, because it was the linear dimension most easily measured.

Fig. 1 shows the values of κ for square and circular blades plotted against the ratio r/s, as determined from the author's experimental results. It will be seen that κ varies very considerably with r/s, when r/s is small, but approaches a constant value when r/s is large; further, that this constant value of κ for the circular blades is about 0.7854 times less than for the square blades.

Fig. 2 shows the author's values of κ for square blades, compared with the values deduced from Messrs. Morgan and Wood's tests when analysed on the basis of Formulæ 1—5. It will be observed that Messrs. Morgan and Wood give no tests on fans for which r/s is greater than 2.5. The point marked P in Fig. 2 corresponds to the value of the constant in Mr. Poppe's formula, Mr. Poppe's tests being made on fans for which the values of r/s varied from about 2.5 to 10.

It will be seen that there is a close agreement between the author's values of κ and those deduced from Messrs. Morgan and Wood's tests. This agreement is all the more remarkable when it is remembered that the author's experiments were made with small blades in water, and using a motor of less than one-thousandth of one horse-power. Such close agreement between tests taken in media of widely different densities appeared to indicate the probability of some error in Messrs. Morgan and Wood's observations on the barometer and temperature effects.

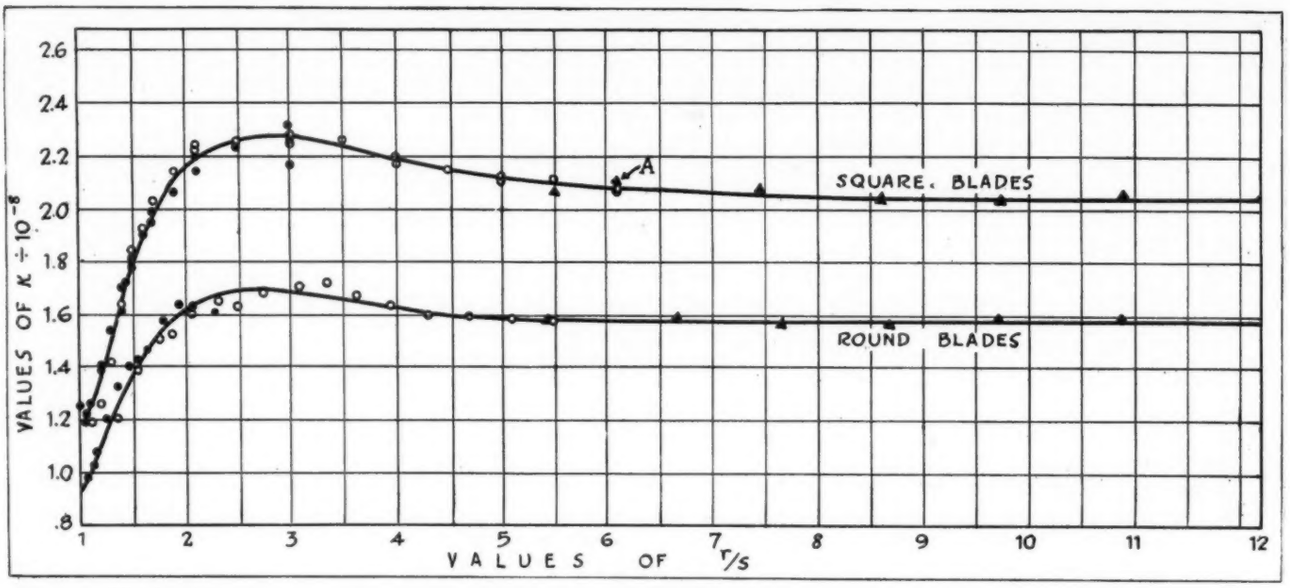
In order to investigate this point further, the author carried out a series of tests on a fan rotated in air under constant torque in a closed chamber. The density of the air in this chamber was changed by small steps from 0.076 to 0.540 lb. per cubic foot by increasing the pressure, and from 0.076 to 0.600 by increasing the temperature.

Over the whole of this range, the relation

$$N^2 W = \text{constant}$$

was found to hold. The check point, marked A in Fig. 1, which was taken with the fan rotating in air, further confirms the conclusion that the resistance to rotation varies directly as the density of the fluid in which the fan rotates.

When testing air-cooled aviation engines an error may be introduced if the temperature of the air in which the blades rotate is not allowed for. This temperature may be obtained by means of a small alcohol thermometer, some 2½ in. long encased in a perforated brass tube, and reading between 60° F. and 120° F., attached to the blades or the extremity of the fan arms. The thermometer should be fixed with its



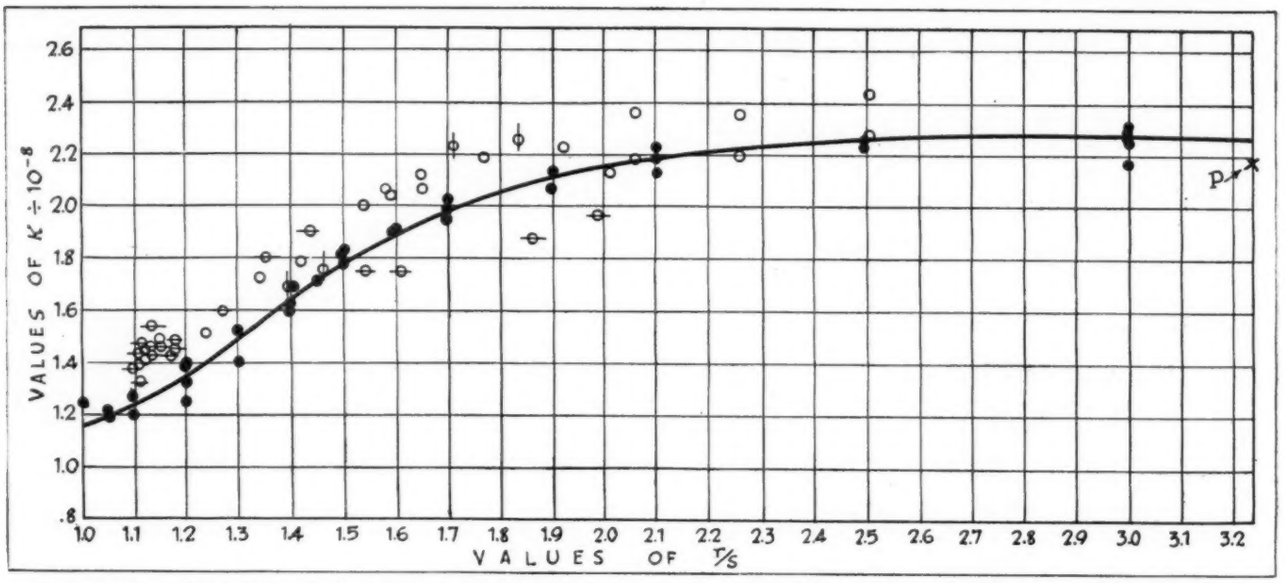


Fig. 1—Above—Curve showing the values of K for square and circular blades plotted against the ratio r/s, as determined from the author's experimental results. Fig. 2—Below—Curve showing the author's values of K for square blades, compared with the values deduced from Messrs. Morgan and Wood's tests when analyzed on the basis of Formulae 1-5

stem radial, so that it does not appreciably interfere with the stream-line flow past the arms and blades. Or, alternatively, the thermometer may be clamped to a pillar resting on the ground, so that its bulb is in the same plane as the fan arms and an inch or so beyond the tip of the blades. In the author's experiments N was varied for any one fan only over a range of 1:3; in Messrs. Morgan and Wood's experiments, over a range of 1:2. These ranges are too small to prove that the N^2 law is followed exactly.

On further reference to Fig. 2, it will be seen that a curve drawn through the mean of Messrs. Morgan and Wood's points would be 2 or 3 per cent higher than the author's curve, and it is somewhat difficult to say whether or not the higher values should be taken.* Values of κ obtained by testing the same engine successively with a fan brake and a Froude dynamometer seem to indicate that the author's values are the more correct. In any case, the discrepancy between the two sets of results is not great for commercial testing.

Resistance Coefficient Easily Affected

It will be obvious that the presence of the engine and flywheel or of a wall or floor in the vicinity of the fan will affect its coefficient or resistance. The author has found that the coefficient of resistance is affected by less than 1 per cent for fans for which r/s is greater than 3, provided that the diameter of the flywheel (to which the fan arms may be bolted) is less than r_a, that the clearance between the tip of the blades and the floor is at least one and a half times the radial width of the blade, and that there is a distance of at least one and a half fan diameters between the plane of the fan and the wall. Too small a clearance between the blade tip and the floor introduces the greatest source of error. If it is not convenient to mount the engine sufficiently high to obtain the floor clearance specified above, a shallow trough should be dug. This should not be deeper than one and a half times the radial width of the blade, and its breadth should be about four times the axial breadth of the blade.

*Messrs. Morgan and Wood do not say how the speed of rotation of the fan was measured in their tests. If a tachometer was used, this may have been in error.

They also do not state the temperature and pressure of the air. In analyzing their results the author has assumed that the density of the air was 0.0763, a figure which corresponds to mean atmospheric temperature and pressure.

In fan brake dynamometers as usually constructed it is customary to make the value of r/s small. It will be seen, however, on reference to Fig. 1, that the experimental accuracy is greatest for the larger values of r/s. Further, the shape of the $\kappa.r/s$ curve is more easily defined from theoretical considerations when the value of r/s is large. The curve can, therefore, be drawn with much greater certainty at these values. Then again, the influence of the engine and flywheel on the resistance coefficient of the fan used is less when r is large, and, for fans installed with similar clearances, the effect of the proximity of the floor diminishes as r/s is increased. For these reasons, it is desirable to design the fans so that the ratio r/s is not less than 2.5 or 3.

Not Highly Accurate

The author has usually found that the fan brake dynamometer is not considered capable, under the conditions of ordinary commercial testing, of giving results of any very high degree of accuracy. It would seem to him that if the above points are taken into account when designing and installing the fans, and if the speed of rotation is correctly measured, and if any variations in the temperature and pressure of the air in which the fan rotates are measured and allowed for, the accuracy of the results should compare very favorably with those obtained by much more elaborate apparatus. A summary of the equations and symbols used is given below:

$$\mu_b = \kappa N^2 r^2 s^2 W \quad \ldots\ldots (1)$$

$$\mu_a = 0.35 \times 10^{-5} \sigma N^2 r_a^4 t W \quad \ldots\ldots (2)$$

$$\mu = \mu_a + \mu_b \quad \ldots\ldots (3)$$

$$\text{H.P.} = \frac{\mu N}{63{,}000} \quad \ldots\ldots (4)$$

Where

W = Density of the fluid in which the fan rotates, in lb. per cubic foot
= 62.33 for water at 50° F.
= 1.347 × barometric pressure in inches of mercury / (460 + temp. in °F.)

μ_a = Torque due to arms alone, in inch-lbs.

μ_b = Torque due to blades alone, in inch-lbs.

μ = Total torque in inch-lbs.

H.P. = Horsepower.

N = Revolutions per minute.

s = Length of side of square blade, or diameter of circular blade in inches.

r = External radius of fan in inches.

r_a = Radius of arms in inches, measured to the inside of the blades.

t = Thickness of arms in inches.

κ = A coefficient depending upon the value of r/s and the shape of the blade for fans rotating in free space.

σ = A coefficient depending on the section of the arms as given below.

It will be obvious that the relation

$$\mu_b = \kappa N^2 r^2 s b W \quad \ldots\ldots (5)$$

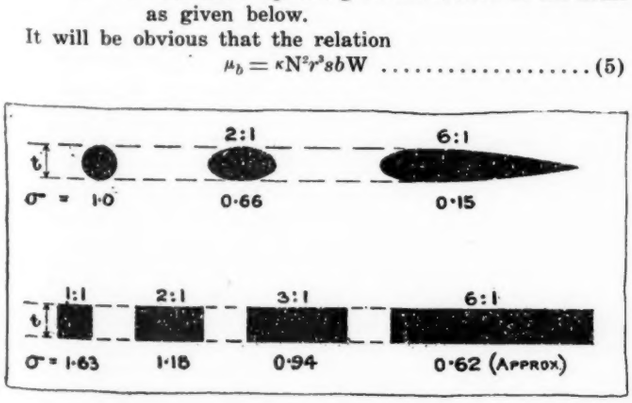


Fig. 4—Values of σ for representative fan arm sections

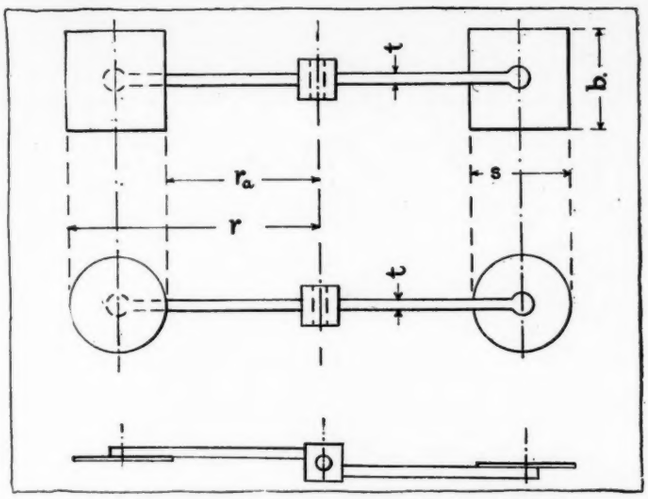


Fig. 3—Measurements of square and circular-bladed fans

where κ is the coefficient for square blades given in Fig. 1, should be approximately correct for rectangular blades of radial width s and breadth b inches. The values of κ calculated from Messrs. Morgan and Wood's tests on rectangular blades by means of this equation are shown in Fig. 2.

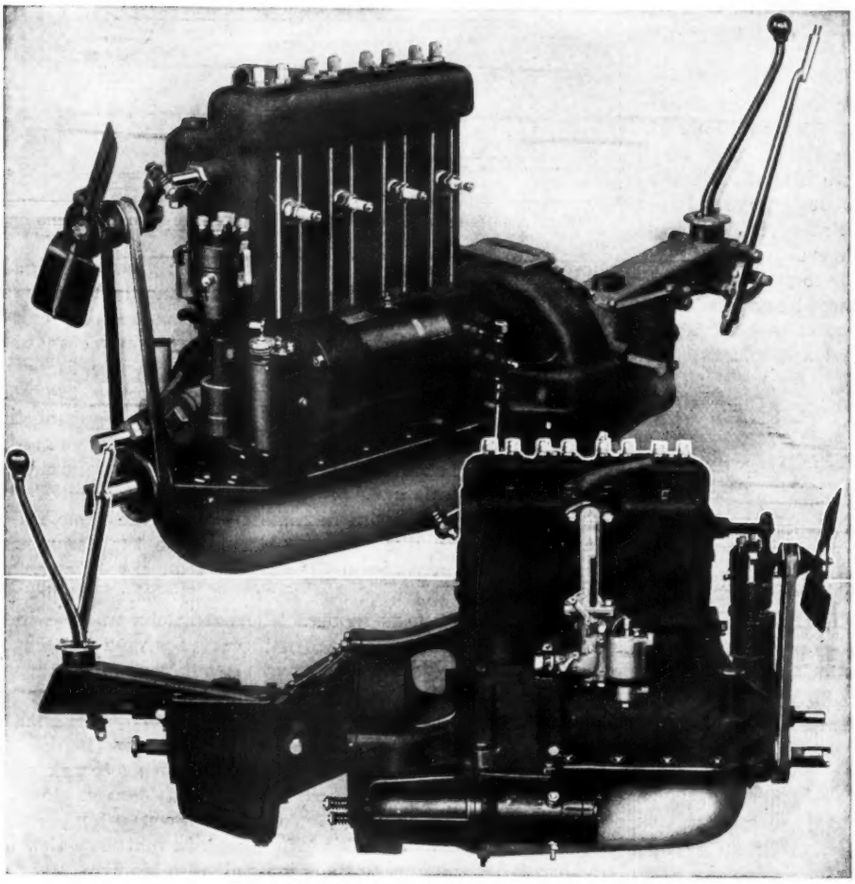
It is interesting to note that when *comparing* the performances of a number of petrol engines by means of the same fan, no correction need be made for variations in the temperature or barometric pressure of the air, as these factors affect the resistance of the fan and the torque of the engine at any given speed in almost exactly the same ratio. The author would like to draw attention to the theoretical interest of this investigation, in which tests made on small models in water are used directly to predict the behavior of much larger apparatus in air. The conditions under which such comparisons may be made with accuracy, and the economies which are possible by carrying out tests in a dense medium such as water, are further dealt with in a paper by the author on "The Commercial Metering of Air, Steam, and Gas," which is shortly to be read before the Institution of Civil Engineers. In conclusion, the author wishes to acknowledge his indebtedness to the careful work of Messrs. Morgan and Wood, and to thank the Aeronautical Society for permitting him to republish in this paper certain matter which he has already contributed to their journal; also his firm, Messrs. Geo. Kent, Ltd., of Luton, at whose works the tests were made, and Mr. F. Gray, who assisted in the preparation of the paper.

California 1915 Registrations

	Cars and Trucks	Chauffeurs		Cars and Trucks	Chauffeurs
Alameda	11,440	1,297	Placer	630	45
Alpine	11	0	Plumas	148	22
Amador	241	17	Riverside	2,844	111
Butte	1,363	57	Sacramento	4.655	688
Calaveras	225	9	San Benito	471	37
Colusa	502	34	San Bernardino	4,404	192
Contra Costa	1,232	79	San Diego	7,232	1,083
Del Norte	96	3	San Francisco	17,763	5,931
El Dorado	203	15	San Joaquin	3,644	223
Fresno	6,177	265	San Luis Obispo	978	101
Glenn	558	23	San Mateo	1,500	281
Humboldt	1,259	215	Santa Barbara	2,469	218
Imperial	1,785	79	Santa Clara	5,275	292
Inyo	247	11	Santa Cruz	1,173	54
Kern	3,320	267	Shasta	401	15
Kings	1,144	16	Sierra	72	8
Lake	234	38	Siskiyou	563	39
Lassen	241	7	Solano	1,011	74
Los Angeles	55,217	7,754	Sonoma	2,535	134
Madera	435	17	Stanialaus	2,486	86
Marin	833	112	Sutter	445	17
Mariposa	86	19	Tehama	556	29
Mendocino	627	45	Trinity	48	8
Merced	883	40	Tulare	3,125	65
Modoc	230	16	Tuolumne	360	29
Mono	18	1	Ventura	1,797	73
Monterey	1,048	119	Yolo	1,045	44
Napa	883	84	Yuba	421	48
Nevada	299	23			
Orange	4,913	239	Total	163,801	20,848

Scripps-Booth Eight Is Four-Passenger

Has Individual Front Seats—Other Models Are Four-Cylinder Roadster and Coupe—Motor More Powerful Than in 1915—Characteristic Body Lines Continued



Both sides of the 3 by 4¼-in. four-cylinder motor used in the 1916 Scripps-Booth roadster and coupé. Above is illustrated the electric generator and ignition apparatus, and below, the mounting of the starting unit

ALTHOUGH it was made known at the New York and Chicago shows that the Scripps-Booth Co., Detroit, would offer for this year a higher-powered four-cylinder model as well as an eight, and some of the details were given it was then too early to obtain complete details of the new productions of this concern, but these are now available and show the main differences are in the power plants.

Like most other automobile manufacturers, the Scripps-Booth company has been obliged to raise the prices of its models somewhat, due to the materials situation, the four-cylinder roadster now selling for $825 and the coupé which is mounted on the same chassis commanding a price of $1,450. The eight-cylinder engine is put in the four-passenger car only, and the chassis for this has a 120 in. wheelbase instead of 110 in., as is the case with the four-cylinder models. This eight is priced at $1,175.

A New Four-Passenger Body

The really new thing in the present Scripps-Booth announcement, however, is the four-passenger body, which follows closely the idea that was prevalent at the shows of making it a sociable affair. There is an aisle between the two front individual seats, this admitting to the rear seat which is 34 in. wide. Entrance to the rear compartment is through the doors at the front seats. The general body lines of this larger Scripps-Booth are the same as those which have been followed in the four-cylinder roadster ever since its inception, and which have occasioned much favorable comment from the motoring public. The radiator is of the V-type and the hood and front of the body carry out the same slope without any disturbing transitory curves. The rear deck of the new body also carries out much of the same shape as the roadster, and there is a wire wheel rakishly positioned at the end of it. The wire wheels, in fact, add a great deal to the appearance of the car.

Overhead Valves on Both

Very little has been altered in the general chassis layout of the new Scripps-Booths as compared with the earlier model, but considerable change has been brought about in the power units. In fact, the influence of the same designer is to be seen in both the new four-cylinder and the eight-cylinder engines, for they both adhere to the overhead valve construction with adjustment for the rockers outside in an exceedingly convenient position. The four has a bore of 3 in. and a stroke of 4¼ in., whereas the eight is 2⅝ by 3¾ in. Needless to say, the new four, with its larger motor, has considerably more power than the 1915 motor, and like the eight, is very accessible for various adjustments or repairs.

Two-Unit Electric System

A change of importance is the fitting of a two-unit starting and lighting system of Wagner make to replace the single-unit system that was formerly fitted to the roadster. The starting motor is placed on the right and close to the flywheel so that it can connect with the flywheel for performing its function. The popular Bendix automatic meshing and de-meshing apparatus is used, whereby the operation of throwing on the starting current by means of a switch in the footboard automatically meshes a pinion on the starter shaft with teeth in the flywheel rim, and once the speed of the engine exceeds that of the starting unit this pinion demeshes again. The details of this starting connection have been thoroughly covered in previous issues, and are well understood by the public. The starting motor is entirely out

of the way, being hung from a bracket below the upper part of the crankcase.

On the four the generator is carried on the left and is driven by the camshaft through inclosed gearing. In the case of the eight the generator is carried in the block between the cylinder castings, and is driven by a belt.

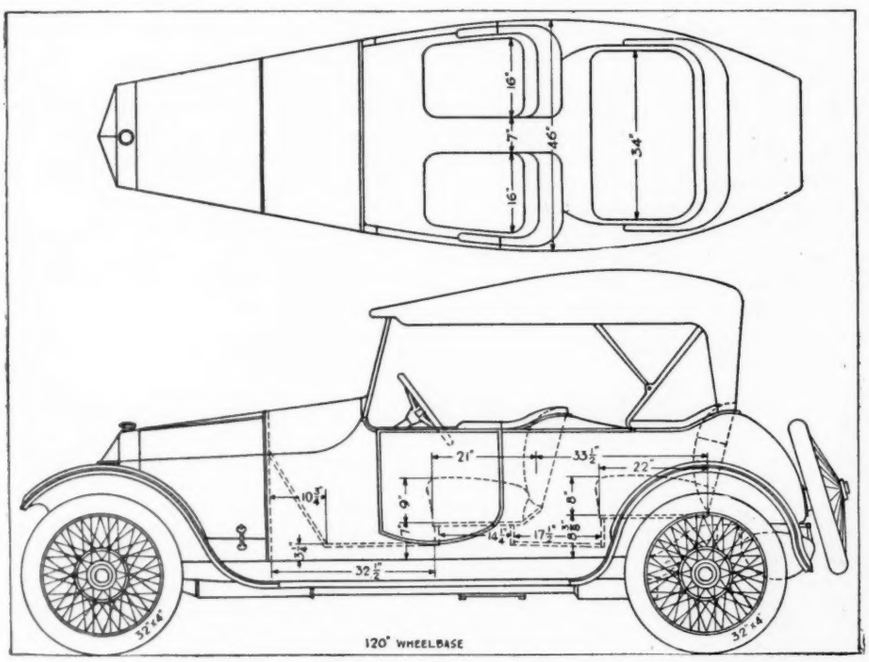
Adjust Valves While Running

One of the motor illustrations herewith indicates clearly how the overhead valves are inclosed completely at the top of the motor. Adjustment of the clearance between the end of the valve rod and the rocker which actuates the valve stem is afforded by the adjusting nut which protrudes through the top of the plate. By means of these adjustments it is possible to adjust the valve clearance while the engine is running if desired. First the cap which goes over the adjustment proper is removed and then a screwdriver may be used to turn the slotted head of the adjusting nut, the locking nut having to be loosened first. An experienced person can tell by the feeling of the valve rod just how much clearance there is. This valve adjusting scheme has been described in previous issues in connection with the Ferro eight-cylinder engines designed by the Brush Engineering Assn.

Motor Mounting More Rigid

Support of the four-cylinder motor in the chassis has also been changed. Instead of hanging the rear end from a bridge, the back part is supported directly in the frame on either side. This makes a more rigid mounting.

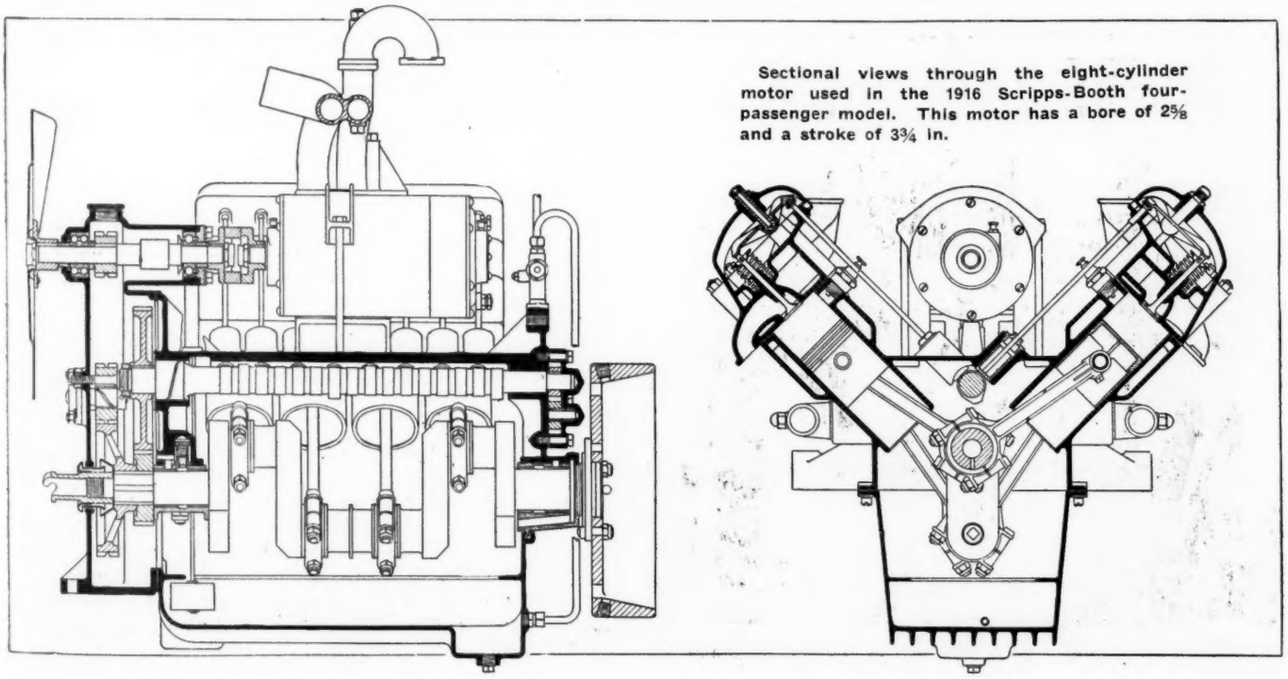
Remy ignition is fitted to the new motors and the means of attachment and drive on the four is clearly brought out in the illustrations. The distributer is vertically mounted, so as to be driven by a worm gear off the front end of the camshaft. The coil is mounted in close proximity to the distributer and both are adjacent to the generator. Centralization of the electric apparatus is the result and it tends to shorter wiring. As the spark plugs are carried in the left side of the cylinder block, it is difficult to see how they could be brought much closer to the distributer.



Layout of the new Scripps-Booth four-passenger body which is mounted on the eight-cylinder chassis for 1916, showing some of the principal dimensions

No External Manifolds

Simplicity has evidently been striven for in the application of other motor accessories in addition to those already mentioned, a fact which is forcibly brought out by the mounting of the carbureter on the right side and the absence of external manifolding. Distribution of the incoming gases is cared for within the cylinder casting, since there is but a single opening for connection to the carbureter. The exhaust manifold is of large proportions and therefore gives free exit for the burned gases.



Sectional views through the eight-cylinder motor used in the 1916 Scripps-Booth four-passenger model. This motor has a bore of 2⅝ and a stroke of 3¾ in.

The oil pan is a pressing which attaches in the usual manner to the bottom of the crankcase and is sloped to send the oil back to the reservoir at the rear, from which it is drawn by a pump and delivered to the troughs under the connecting-rods. This is what might be termed a circulating splash system and applies to the four-cylinder motor only. On the eight the lubrication system is of the pressure type, in which the oil is fed by a pump to the motor bearings, and thence through drilled passages in the shaft to the crankpins. It is not splashed.

Eight's Maximum 2500 R.P.M.

These new Scripps-Booth motors attain moderately high speed, the four having a maximum of 1800 r.p.m., and the eight running up still higher to 2500. The reciprocating parts have been designed to take care of the speed running with a marked absence from vibration. In both designs the crankshaft and camshaft are each carried on two bearings of the conventional plain type.

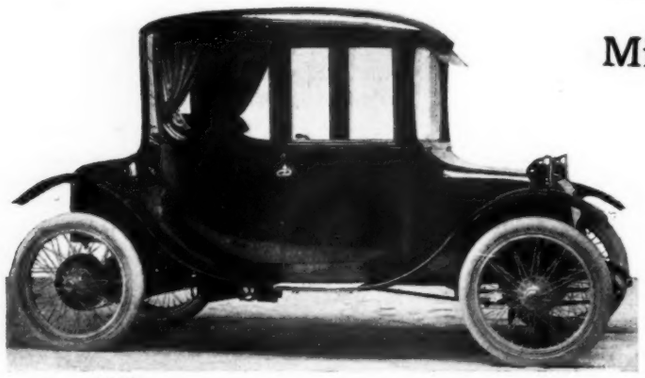
Back of the motor there is practically nothing new to the chassis. A multiple disk, dry plate clutch is used and a conventional form of three-speed gearset that is very compact and bolts to the semi-housing that covers the top of the flywheel and is an integral part of the cylinder casting. The rear axle is a three-quarter floating type, to which the power is conveyed by an open propeller shaft fitted with two universal joints. Front springs are semi-elliptic and the rear set are of cantilever type. In the braking system, the use of piano wire cable to connect the brake operating levers with the grounds. These cables are provided with a very easy form of adjustment to take up the slack and have the advantage of extreme simplicity along with freedom from rattles. Scripps-Booth, in fact, is the pioneer in this form of brake control.

Vacuum Fuel Feed on Four-Passenger

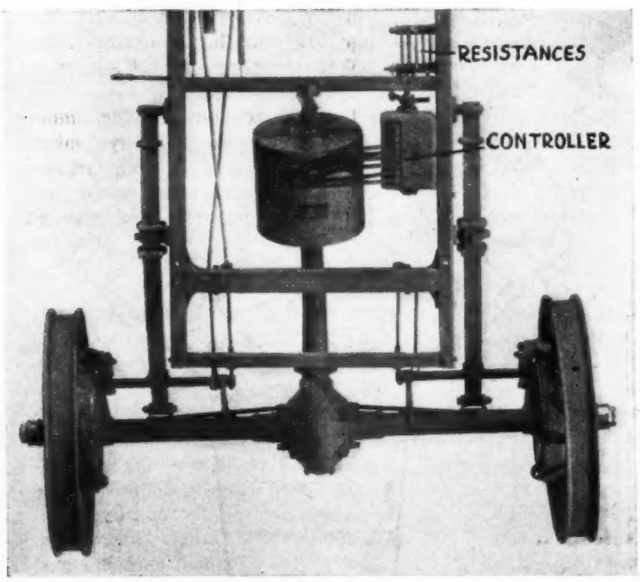
One other new feature of the four-passenger model is the use of the vacuum system of supplying the fuel to the carbureter, the supply tank being carried at the rear below the wire wheel deck.

Some of the dimensions of the four-passenger body which the Scripps-Booth designers have been able to fit to the wheelbase of 120 in. will indicate the cleverness with which all of the available space in the body has been used to advantage. From the front to the back of the front seats the dimension is 21 in. and they are 16 in. wide with an isle between that is 7 in. wide. The greatest width inside the body is 46 in., and from front seat to back seat is 33½ in., the distance from the front of the front seat to the front of the dash being the same amount. Easy riding in the back seat of the new four-passenger is fostered by bringing the seat sufficiently forward so that the passengers really sit ahead of the rear axle with the obvious advantages resulting from such a position.

Tire equipment of the eight-cylinder model consists of five 32 by 4 tires carried on wire wheels. One extra tire and wheel are also supplied to the four-cylinder cars, the tires in this case being 30 by 3½.



The new Milburn electric brougham selling at $1,585



Rear of Milburn chassis which carries the new brougham

Milburn Adds a Brougham to Its Line of Electric Cars

New Model Will Sell at $1,585 and Is Mounted on Same Chassis as the Roadster

BESIDES continuing its model 15 chassis on which are mounted the coupé and roadster models, the Milburn Wagon Co., Toledo, Ohio, has added to its line of electric cars a new model. This is a brougham to be known as model 22 and sells for $1,585, being designed primarily for those who desire a larger electric than the other models.

The brougham is not unlike the coupé in appearance, but considerably larger. It measures 63½ in. from front to rear glass; its doors are 26½ in. in width and its cushions are wider and deeper than those in the other cars. The windows are raised and lowered by the Dura mechanical window lifter.

New Car Is Not Heavy

Although the new model is larger and even more luxurious than the company's former models and has a wheelbase of 105 in. as compared with 100 in., and 32-in. wheels as compared with 30-in. wheels on the coupé, it weighs but a few pounds more than the latter. Improvements in designing and the use of steel drop forgings and high grade steel have made this possible.

Cantilever Springs in Rear

Cantilever springs are used in the rear, which give the best possible riding qualities; General Electric motor and controller are used and the spring bolts are provided with self-lubricating bushings, which obviate the necessity of turning up grease cups; the standard battery consists of twenty-two cells of 17 W. T. X. I. Philadelphia diamond grid plates. For those who desire even greater speed than normally provided, a larger cell equipment is offered at a small additional expense. Edison batteries also can be obtained at extra cost.

The FORVM

KEROSENE MUST BE NATIONALLY DISTRIBUTED—NO DRAWBACK TO TRANSVERSE STEERING LINK MOUNTING—EFFICIENCY IN CAR COLORS

Difficulties To Be Met in Kerosene Carburetion

By E. H. Sherbondy
Clay & Sherbondy

IN review of the use of kerosene and heavy oils in automobiles and trucks the first matter of importance is that of distribution of kerosene. We now have nation-wide distribution of gasoline, a matter which has required a great deal of thought and effort on the part of refiners and manufacturers, and really good distributing facilities for gasoline have only been available for about four years past.

May Use Heavier Fuel Oils

If the refiners do not develop commercial methods of distillation, which very largely increases the yield of gasoline, or more properly motor fuel, it will undoubtedly be absolutely imperative to operate at least a part of the motor vehicles on the heavier fuel oils, kerosene, benzol, etc. It is therefore apparent that one of the first steps will have to be to arrange the distribution of kerosene in much the same manner as has been done with gasoline. It is not now possible to conveniently purchase kerosene in quantities for motor vehicles.

The next step of importance is to adapt that class of motor vehicles which most readily lend themselves to the use of kerosene for a fuel. Unquestionably the motor truck will come first, especially the slow-speed, heavy type truck.

There can be no doubt whatever that the cost of distribution must increase the price of kerosene, when such distribution is arranged broadcast as is now the case with gasoline.

Because the truck motor carries a very much heavier normal load (b.hp.) than the pleasure vehicle, it operates with a higher average compression, and within a narrower speed range, thus approaching conditions met with in the operation of stationary and marine engines. All of this is favorable to the use of kerosene as a fuel.

Disadvantages of Jacketing

For many years past, marine and stationary four-stroke cycle kerosene engines have used vaporizing chambers to effect the carburetion of combustible mixtures, and the general method pursued has been to jacket the vaporizing chamber and heat the liquid fuel-air mixture by means of the exhaust gases. There are a great many disadvantages to this mode of procedure, since with varying load, the heat available in the exhaust gases varies and is greatly reduced during closed throttle operation, and when operating at full load too much heat is supplied by the exhaust gases, resulting in serious decrease in the volumetric efficiency. The slow choking up of the vaporizing jacket chamber is also a problem encountered, and is caused by partially burned fuel and lubricating oil vapor being thrown into the exhaust passages when the motor is throttled close. (Poor vaporization and great depression in the cylinder during suction stroke.)

A kerosene vapor-air mixture cannot be compressed more than 47 lb. above atmosphere without encountering pre-ignition and severe pounding, excepting when water injection is used to reduce the compression temperature. The quantity of water necessary is from two to five times the quantity of fuel supplied, depending on the homogeneity of the mixture.

When using a vaporizing chamber in connection with an ordinary metering device, such as a gasoline carbureter, the distribution of the fuel particles throughout the volume of air aspired is usually very poor, and when combustion takes place within the motor cylinders the localized oil vapor is subjected to a cracking process, in which hydrogen gas is liberated and solid carbon particles are formed, part of which adhere to the walls of the combustion chamber, and part of which are rejected with the exhaust gases. The carbon formed in this way may be of two varieties, amorphous or crystalline. Amorphous carbon will be readily consumed under full throttle conditions, and its formation is not particularly detrimental, but crystalline carbon is formed under very different conditions than the amorphous variety, and requires enormous temperatures for its combustion to be effected. Adhering to the combustion chamber walls, whose temperatures are always relatively low, crystalline carbon builds up in the manner well known to motorists in the case of gasoline engines.

The use of water is a further palliative in motors operating on kerosene, since the steam particles act as carrying agents for the carbon, and tend to prevent its formation within the motor cylinders.

Combine Carbureter and Vaporizer

The best solution for the use of kerosene in present design truck motors is to build a combined carbureter and vaporizer, in which a very thorough distribution of the fuel throughout the air is arranged for, so that a homogeneous oil-vapor-air mixture is supplied to the motor, at as low a temperature as is possible.

It is extremely important that the constant level chamber and metering orifice of such a device be not greatly heated, since the changes in viscosity in kerosene at varying temperatures will upset the mixture proportions, which may have been determined for any initial temperature and size of metering orifice.

Two Methods of Starting

Two methods of starting are available with vaporizing carbureters. One is to start the motor on a small quantity of volatile liquid fuel and then utilize the heat of the exhaust gases for vaporization of the kerosene after the motor has started. The other is to burn part of the kerosene which has passed the metering orifice, in what may be termed a producer chamber, to insure vaporization of the oil fuel required in the combustible mixture. The products of combustion, oil vapor and air may be very thoroughly intermingled and then supplied to the motor cylinders through the usual intake manifold. Ignition in the producer chamber may be started, and if necessary continued, by means of high-tension electrodes disposed within the producer chamber and

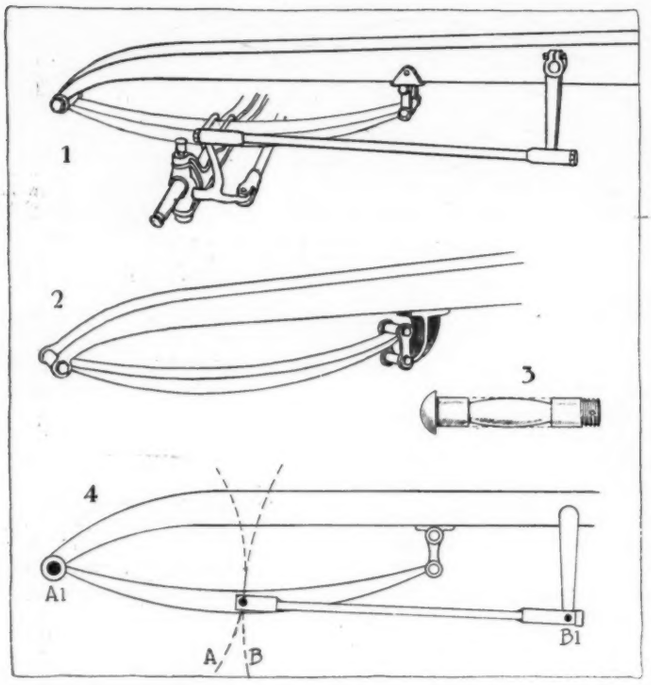


Fig. 1—Usual fore and aft type of steering link. Fig. 2—A pull shackle as an improvement on the push variety. Fig. 3—How a front spring bolt usually wears. Fig. 4—Cause of front wheels wobbling

arranged to discharge the current supplied from a high-tension vibrating coil and battery system.

Another means is to use a blast lamp for initial heating of a "hot tube" disposed within the producer chamber.

The very rich and highly heated oil vapor produced in this way must be reduced in temperature, before admixture with the main air supply, in order to prevent combustion of the entire fuel within the intake manifold.

Even with such carbureting devices as outlined, operation is not entirely satisfactory, nor is combustion complete.

A constant load, with compression in the neighborhood of the limiting values, makes possible only fair operation, with fuel consumption greatly in excess of what would be the case were gasoline used.

Further, because "localized" oil vapor in the charge is usually the rule, rather than the exception, combustion proceeds during the entire expansion stroke and sometimes during the entire exhaust stroke. Of course this results in enormously increased heat losses to the walls of the cylinder and requires more active cooling.

Temperature Changes Are Factors

Oil engines of all varieties are very sensitive in operation to temperature changes, usually because part or all of the vaporization of the fuel depends on the heat of compression to effect the vaporization. In oil-vapor-air mixture engines, low temperatures result in condensation during the suction stroke to a greater or less extent, and high temperatures cause pre-ignition, firing compression of the mixture.

The real solution of the vehicle oil motor problem lies in a rational design and construction of a motor to suit the fuel, and the future freight automobile and probably the aeroplane must have motors capable of highly efficient operation on heavy oils.

It should be the immediate business of the S. A. E. and the National Automobile Chamber of Commerce, Inc., to investigate thoroughly the possibilities of present design carbureters and vaporizors for use with kerosene. For the future necessity of the industry, a concentrated effort should be made to break away from tradition and evolve new types of internal combustion engines which will embrace the present facility of operation and reliability possessed by light fuel oil motors, together with efficient operation on heavy fuel oils.

Transverse Steering Link Not Objectionable

By Theo. D. Stanley
General Service Engineers Co.

THE article by H. H. Dyke in THE AUTOMOBILE for March 23 on "Faults in Front Spring Suspension" has come to my attention, and appears in error in one or two particulars.

In the description of the effect of up and down movement of the car as producing a movement of the axle in the arc *A*, Fig. 4, because anchored at one end *A*1, if there was no flexibility this would be true, but, owing to the spring deflection, another reverse arc is created. The increasing or straightening of the curvature of the spring produces a shortening or lengthening of the distance between the axle and the forward end pivot or anchor of the spring, producing a slight lengthening or shortening of the wheelbase of the car. This movement still further accentuates the action noted by you.

It does not appear to me there is any "obviously undesirable" reason why a steering link should not run crosswise to the car, but, on the contrary, some advantages.

In the mounting of the steering-gear, the farther forward it is placed, the less distortion by the rear wheel and spring deflection is produced to be added to the fore wheel displacements in the fore and aft steering-gear mounting.

The link connections are longer and possible of suitable curvature, for those parts in equipping by cross link method as indicated in A. L. Clayden's article on Improving the Steering in THE AUTOMOBILE for Sept. 2, 1915, create an arc of greater radius.

Since the tie rod has to cross the car, there is no reason why the link should not, and with a full irreversible steering-gear is, theoretically, the best way with present form of spring suspension.

Lighter Colors Are Most Efficient for Cars

By M. C. Hillick

THE AUTOMOBILE has consistently and with convincing logic set forth, in past issues, the drawbacks and disadvantages of the blacks and blues and greens, the two latter of the deepest shade, as colors for use upon automobiles. These pigments, it must be conceded, are, at the outset of their career on the surface of the car, and when given the full radiance of a fine fabric of varnish, exceedingly beautiful to behold, and if they could be made to wear on with the same magnificent effects, and at the minimum outlay of cleaning processes be maintained at a high rate of efficiency under the stress of everyday service, their value and usefulness would pass unquestioned. Unfortunately this is not the case, and wherever these colors are found doing service on the average American highway, there you may expect to find difficulty in keeping them clean and neat, and showing a reasonable amount of luster. Moreover, they are colors ground in japan, and therefore afflicted with a brittleness which under severe road and garage treatment is certain to suffer. They will, of course, give a better account of themselves if kept well protected under an ample supply of varnish, but in the face of all that may be done for them—speaking now of the colors used upon the cars exposed to the conditions of the average country and village highway—the tendency

is to show a dingy, unkempt, and generally unsatisfactory appearance.

Must Consider Conditions

The exception to this rule is the color used upon the car employed for service upon city pavements, where the conditions of service are of a modified order, as compared to those encountered in the rural districts. These black, deep blue and green colors require a dressing-up with some of the ornamental embroidery of relief colors to take them from under the funereal aspects which such field colors always invite. In other words, they require an artificial stimulation to keep them in presentable condition for even a temporary show.

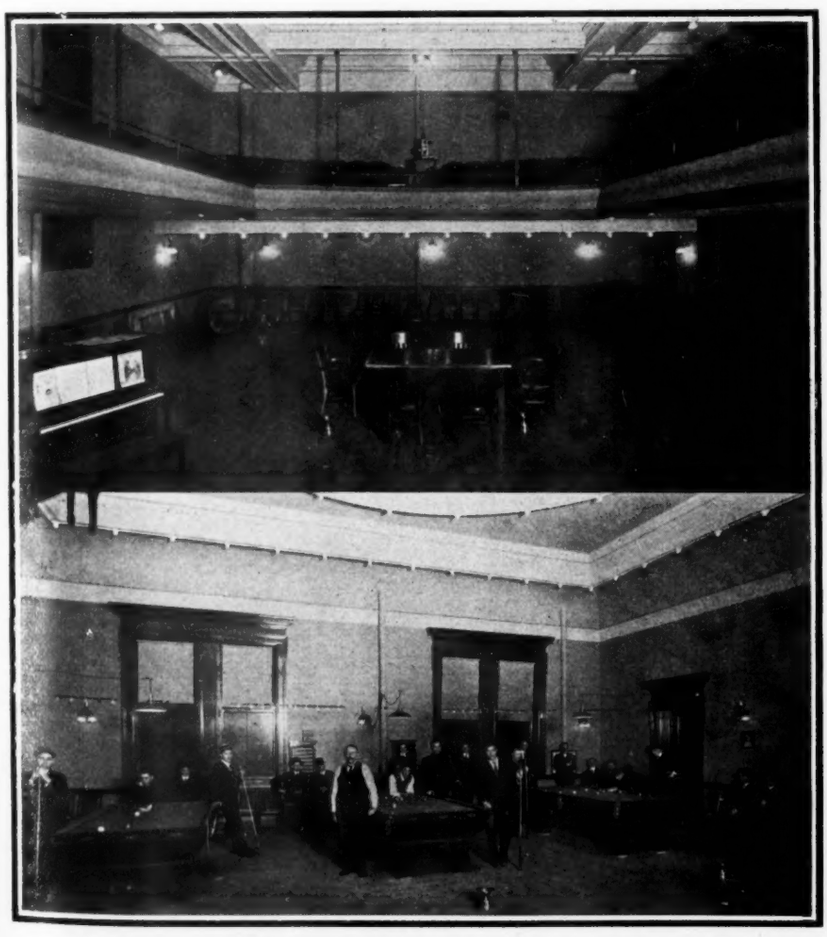
In respect to the employment of lighter colors, such, for example, as maroon, some of the browns, the grays, creams, wine and the lakes. These colors, some of them also ground in japan, have the important advantage of being comparatively easy to clean up and to be kept clean. Also, they retain their brilliancy of effect to the maximum limit. They show dirt less than darker colors, and respond to the cleaning operations quicker. They render service in proportion to the attention bestowed upon them but at the same time they flourish under neglect and display color effects that would make the darker pigments look like a vain show. The grays, and the creams, and lighter yellows, all are permanent pigments by virtue of the ingredients composing them, white lead being an important one, and a basic feature of the greatest value as a surfacing medium. Such a pigment, naturally supple and elastic, imparts to the color a surfacing property, a density of fiber and film, and an elasticity quite unsurpassed, and explains the tenacity and the durability which characterize these pigments with a pronounced lead base. Give these colors a proper fabric of varnish, and a decent measure of care taken, including proper washing processes, and the service they will render cannot fail to equal that of the very best pigments.

Stand Washing Well

Practically all these colors stand washing and cleaning operations excellently, which may be accepted as evidence of their durability and strength of film. Likewise, they show road dirt and the accumulations of the highway less than the darker colors. They require less of the ornamental effects to bring them into notice, the field color being capable of making an impression without the aid of any ornamental lines, although, of course, these lines serve to lighten the effect and bring into greater relief the true and distinctive character of the field color.

White Lead Gives Elasticity

All colors having a portion of white lead in their composition may be accepted as pigments of an elastic nature, and capable, under reasonable conditions, of giving a masterful measure of durability, at the least possible outlay on cleaning and renovating. The black and the darker colors referred to fail in the capacity to stand the renovating processes without detriment, especially when the protection of varnish has become of no effect, whereas the lighter colors bear these erosives with fewer indications of injury to their luster and general appearance. In making choice of color for the car, its class of service may well govern the selection.



Above—Auditorium of the Robbins & Myers clubroom. Below—Billiard and pool room

Robbins & Myers Clubrooms for Employees

THE Robbins & Myers Co., Springfield, Ohio, is one of the progressive companies which have established clubrooms for their employees. About two months ago this company organized and equipped at its own expense a club which is now occupying the entire fifth floor of the Bushnell Annex, Springfield, an office building in the down-town part of that city.

The club is for the use of employees only and no charge is made for membership, all expenses being paid by the company. The membership is composed of the male employees only, and there is no separate club for female help connected with this particular club; however, at the factory building a music room, rest room and other conveniences in the nature of a club is provided for the female employees.

The club contains a reading room and lounge, pool and billiard room, large dance hall and auditorium. These have proved popular with the employees who have made a good attendance every evening since it has been opened.

About once a month a speaker is engaged to address the club members in the auditorium and a banquet or buffet luncheon is served at these meetings. The auditorium is also used by a band composed of the company's employees.

A manager is employed by the Robbins & Myers Co. to run the club, and there are no officers other than the factory superintendent of the company, who is in charge.

Motor Trucks Expedite the U. S. Army's

Left—Above—An old blacksmith shop where army carpenters did the forging of braces and brackets for the wagon bodies that were mounted on White trucks

Left—Below—Loading with rations at the Q. M. depot in Columbus, N. M., where the Villa bandits killed many Americans and attempted to burn the town

Middle — Fleet of White trucks loaded and awaiting the order to go to Casas Grandes with supplies for the American columns pursuing the Villa bandits

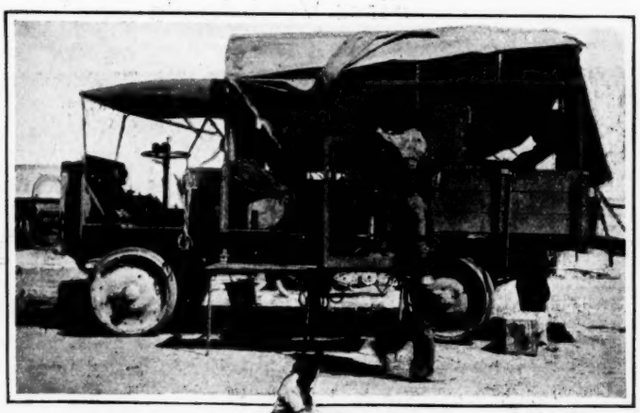
Bottom—White army trucks on the road to the field base at Casas Grandes

Pursuit of Bandits into Mexican Deserts

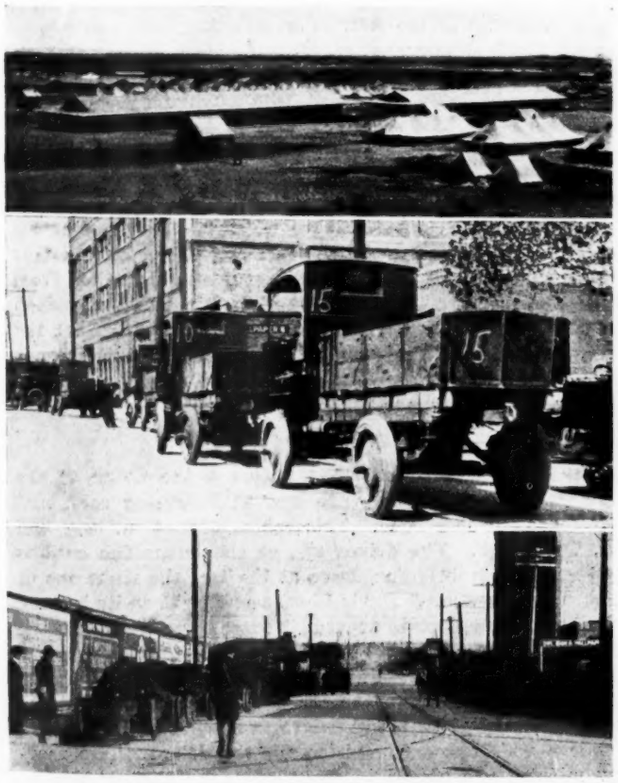
EL PASO, TEX., March 26—It was but a few days ago that government orders were received at the Packard and Jeffery plants for a squad of trucks for Mexican service. Day before yesterday the chassis arrived here; this morning the entire fifty-four, fitted out with regulation U. S. Army bodies, set out on their 20-mile trip over border roads to headquarters at Columbus, N. M., fully equipped, each with a full load of army supplies, and not so much as a single screw missing.

Hardly had the trucks been driven off the flat cars under their own power than a crew of carpenters went after them with hammer and saw and the regulation army bodies were fitted at the rate of one every fifteen minutes. These, bodies, taken from two-mule-team army transports, are equipped with side boards and easily hold the 2-ton capacity of the trucks, in compact army supplies.

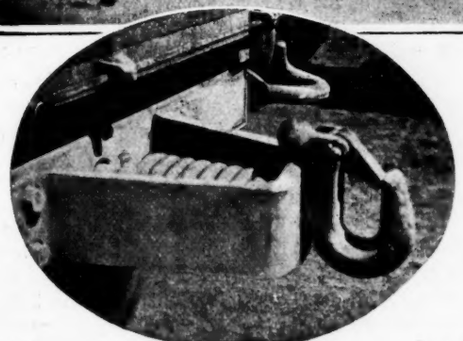
The civilian drivers, recruited in Detroit and Kenosha, fitted out in regulation army uniform, were eager to get under way, and made a decidedly businesslike impression as they lined up for inspection before the start. Each man is equipped with a big .45 army automatic, cartridge belt, canteen, sweater jacket, knickers, canvas puttees, substantial tan army shoes, khaki shirt and the regulation U. S. sombrero. Truckmaster Carl W. Newell has been connected with the Packard service in Mexico for six and a half years and is thoroughly familiar with the territory in which his charge of twenty-seven trucks will operate. Truckmaster E. H. Mahoney of the Jeffery contingent is confident of the success of his cars in the desert country, as the squad which preceded him has demonstrated their efficiency.



Above—A Jeffery quad fitted with a completely equipped machine shop. Below—A load of bodies for the new trucks



Upper—General view of the camp at Columbus, N. M., looking toward Mexico. Middle—Jeffery quads with bodies completed. Lower—Some of the trucks loaded and waiting the word to start



In the foreground of the upper illustration is the first Jeffery quad to make the round trip to the front at Casas Grandes, Mexico. Below is shown the substantial Jeffery coupling

Mack 2-Ton Armored Truck for N.G.N.Y.

First Vehicle To Be Completed Carries Two Guns

Mack AC 2-ton armored truck for N. G. N. Y. motor battery

AN armored motor truck battery, with a quota of 160 men and six officers, has been formally mustered into the New York National Guard. For its equipment, which will probably comprise ten vehicles, four experimental armored cars are being prepared. These are to be built on the following chassis: a 2-ton worm-driven AC Mack, a White 1½-tonner, a four-wheel-drive 2-ton Jeffery, and a Locomobile six-cylinder touring car chassis; there is also a 2-ton four-wheel-driven Jeffery with a steel service body. Funds for this equipment were provided by Judge E. H. Gary, H. C. Frick, Col. R. M. Thompson, D. Olcott, J. N. Wallace and Capt. H. G. Montgomery, who will command the battery.

New Rear Drive Steering Device

A new device to provide rear-end drive has been developed and will be applied to all of the vehicles. This consists of a dummy steering wheel and an electric signal at the rear by which an indicator on top of the front steering wheel will be turned, permitting the rear steersman to direct the actual steering by the driver when running backward. This is considered superior to the dual-steering means which has been used in Belgium and experimented with in this country, owing to the concentration of the actual driving at one point and to the elimination of the lost motion which seemed inseparable from the other construction.

The Mack AC Armored Truck

The International Motor Co. has just finished the construction of the Mack armored truck. This is the heaviest of the experimental types and is fully armored. The chassis is the AC model of 2 tons' capacity and with the body and equipment weighs 9052 lb.

It is designed to carry two rapid-fire guns, ammunition and a crew of gunners. The armor is made of a special heat-treated steel of great hardness and resists regulation U. S. Army rifle or machine gun fire at 50 yd. It completely houses every portion of the chassis and practically every surface is above the wheels on such a slant that bullets will be deflected.

It consists of four sections; the hood, the cab and two body sections, each of which has its own angle-iron frame. Each unit is capable of being dismounted separately, and with the two rear sections removed, a platform truck for the transportation of supplies is formed. It stands 100 in. high overall, the armored sides extending down to within 1½ ft. of the ground and up to a height of 6½ ft. The floor is about 2¾ ft. above the ground and the sides extend 3¾ ft. above the floor, so that in a sitting, kneeling or crouching position, the men are entirely protected.

Two Rapid-Fire Guns

The armament consists of two rapid-fire guns, mounted on fixed tripods, fitted with barbettes or shields which extend above the armored sides. One of these is located in the front section of the body and on the right side and the other at the rear and to the left. For rifle fire, seven loop-holes or ports, with sliding shutters are provided, one at the rear, two on each side of the body and one on each side of the cab. The wheels are of wood with steel disk armor, the rear wheel being half covered by the armored sides.

The motor occupies the front portion of the vehicle, as usual, the radiator in front being protected by a curved steel box. This box has a large air opening at the bottom, below the bottom of the radiator, above which is a sheet of armor which effectually prevents bullets reaching the radiator, either directly or by deflection, regardless of the direction from which they come. The motor hood is hinged at the dash and may be raised entirely, or the two sides, hinged at the eaves, may be raised independently. The armor belt extends down below the crankcase, so that bullets intended for the crankcase will be stopped.

Driver's Seat Is Low

So that the driver's cab may be below the range of the guns, the driver's seat is very low, as in racing cars, and protected by a deep cowl. This cab is 4 ft. 4 in. long and 4 ft. 7 in. high. The driver sits at the left. The cowl is fitted with two ventilation doors at the top, the right one of which carries a Gray & Davis 10-in. searchlight on its bottom, so that when the door is opened, it extends upward. On the roof of the cab is a hatch, hinged at the front, which provides ventilation and may serve as an additional shield to the rear portion. At the front of the cab is a shutter hinged at the top and extending the full width, which is adjustable to provide a wide or narrow vision for the driver. Two rear-view mirrors are placed in front of each cab port-hole to give the driver a view behind.

No roof is provided, and there is only one door, which is at

the rear. The rear wheels are given clearance under the low floor by steel wheel houses. All doors, hatches, etc., have either refrigerator type latches or wheel-nut hold-downs.

Electric lighting and starting are features, so that the motor may be stopped and started while under fire without exposing any of the men to fire. Besides the disappearing searchlight, there are two headlights and two tail lights. Both of these are placed very low, so as to concentrate the light on the ground and prevent its carrying any great distance.

Ignition Circuit Is Separate

The storage battery used for lighting and starting is separate from the ignition, the latter being supplied by a Bosch magneto and a dry battery. There is an electric dash light under the cowl to light the instruments and a socket for an extension light. Two fire department kerosene lanterns and two Pyrene fire extinguishers are mounted inside the body. A tool box is placed to the left of the driver's seat.

The radiator is of specially large size to insure cooling under difficult operating conditions and to compensate for the somewhat restricted air circulation. The fuel tank is located below the floor, completely protected by the armor and feeding by the Stewart vacuum system.

For towing purposes, a special spring-cushioned drawbar is provided at the rear, anchored to the rear frame cross-member and extending in a ring back of the rear armor plate.

As most of the armor slopes toward the top, the joining of the plates has been difficult. For this reason and also to prevent chipping the edges of the plates by bullets, butt straps are provided at all joints, thus making these doubly strong and preventing opening of seams.

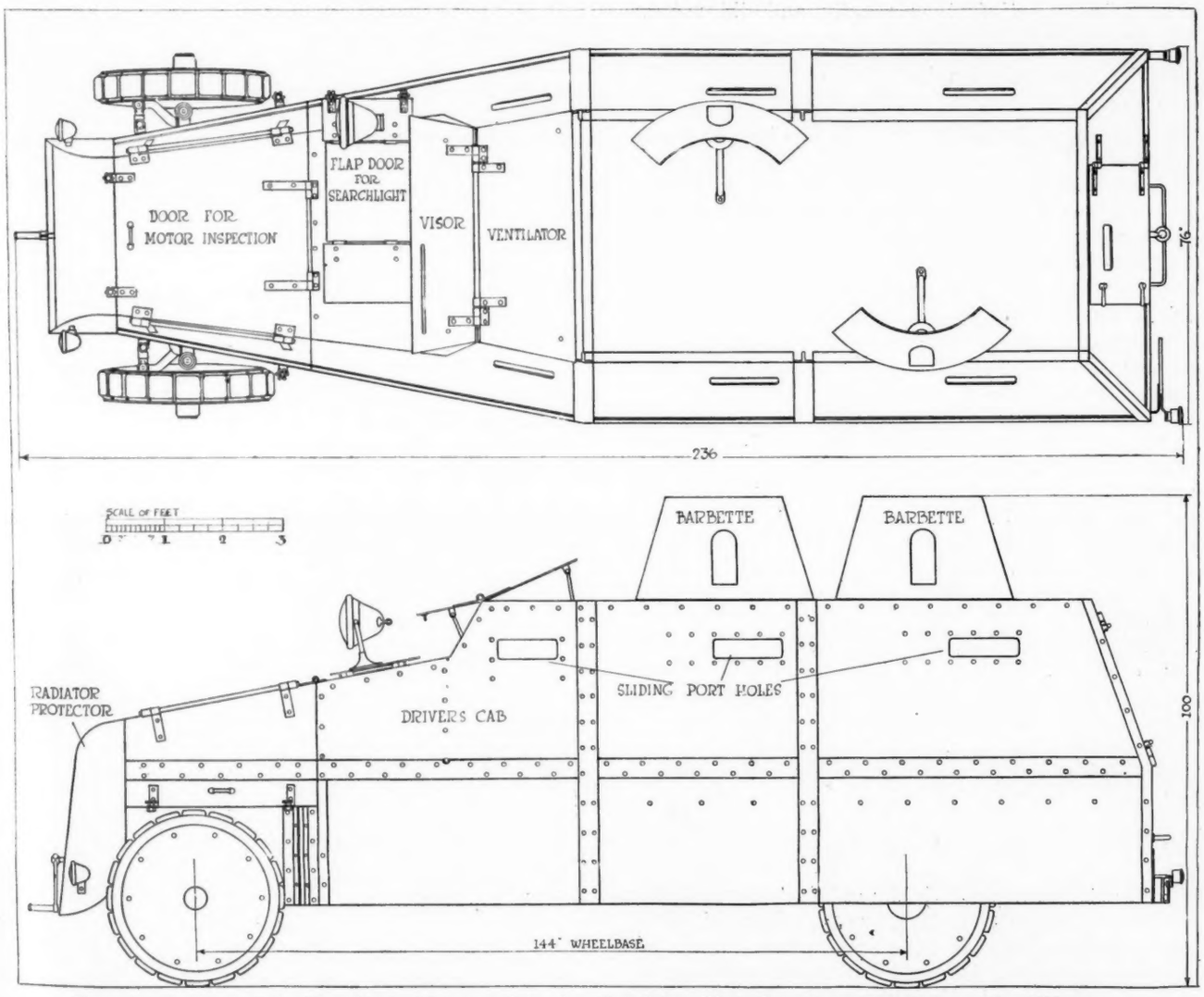
Armor Plates Heat Treated

To illustrate the painstaking care with which this armor has been constructed, the armor itself is cut and drilled at the steel mill and then the plates straightened to conform exactly with the drawings. They are then heat-treated and cannot be drilled or machined again without re-annealing. All bolts and nuts used in the construction of the armor are of special steel, heat-treated and hardened, to prevent their being shot away. There are 600 of these bolts.

Barbettes are mounted on cast bronze frames and are arranged to pivot fore and aft and to swing from side to side. Their backward slope not only provides for bullet deflection, but permits of considerable elevation of the aim, useful in case of use in anti-aircraft work.

Detail weights of the different components follow:

Part	Lb.	Part	Lb.
Chassis	5000	Extra wt. radiator	15
Armor	2400	Fuel tank, etc.	50
Frame for armor	600	Battery	67
Platform	200	Butt straps	250
Drawbar	40	Special bolts	60
Radiator guard	120	Barbettes	250
		Total	9052



Plan and elevation of the 2-ton Mack AC armored truck. Complete with body and equipment, it weighs 9052 lb.

The History of the American Automobile Industry—24

Clerk's Two-Cycle Engine First Construction to Avoid Infringement of Otto's Patent—Selden Begins Work on a Brayton-Type Engine—His Patent of 1895

By David Beecroft

AFTER Nicolaus Otto developed the first four-cycle explosion type engine in 1877, and demonstrated its practicability, it was not long before the general value of this engine was recognized, and as it was broadly covered by patents manufacturers had to pursue one of two courses, namely, pay royalty on the Otto design, or develop some different type of engine which produced fairly satisfactory results and did not infringe on the Otto patents.

Clerk's Two-Cycle Engine

A pioneer in this development of a different type of engine was Dugald Clerk, an English engineer, still living, and looked upon as one the greatest authorities to-day on the explosion engine. Clerk has a large following abroad and visited this country some years ago to give expert evidence in the famous Selden patent case. It was in 1878 that Clerk developed his first engine which did not infringe on the Otto patent. Otto developed a four-cycle engine, Clerk developed what is known to-day as the two-cycle engine. Otto had an explosion every other revolution of the crankshaft, Clerk had an explosion every revolution of the crankshaft. Thus we find Otto and Clerk the two names that stand for the two broad types of explosion engines, and even to-day the four-cycle engine is frequently referred to as the Otto cycle, and the two-cycle engine, now in very little use, as the Clerk cycle.

Clerk's engine, Fig. 1, used two cylinders, one a working cylinder C, in which the piston operated, and the other a pumping cylinder P, which was used to force a charge of explosive mixture into the working cylinder. The explosive mixture entered through a positively-controlled valve in the head of the cylinder, which was given a conical or hemispherical construction.

The Modus Operandi

The modus operandi of Clerk's engine was similar to that of the two-cycle design of later years. At the lower end of the stroke the piston uncovered an opening X through which the exhaust escaped. In the head was a rotary, slide, or other form of valve, correctly timed to admit the fresh charge from the pumping cylinder. He used a conventional type of connecting-rod used by Otto and invented by Gilles.

After Clerk started the two-cycle movement there was much general activity in the development of two-cycle engines during the life of the Otto patent which restricted the use of the four-cycle principle. Some of the keenest inventors took up the two-cycle principle because it furnished an explosion for every crankshaft revolution which was considered a more efficient type than the four-cycle Otto. Some of the other names of early inventors in the two-cycle field were Day, Robson, Stockport and others. Practically all of them employed the same mechanical arrangements for regulating the intake and the exhaust. All of them did not make use of the pumping cylinder to inject the mixture. Some used what has come to be known as the differential piston in which the piston itself served as a pump. Others used the pressure in the crankcase and took the mixture in through the crankcase so that the down-stroke of the piston served to force it into the combustion chamber.

Daimler's Compound Engine

It is not surprising that after the development of the four-cycle and two-cycle engines so close together, Otto and Clerk, that other methods of getting greater efficiency from explosion engines would be developed. Thus we find in 1879 that Gotlieb W. Daimler of Deutz-on-Rhine, Germany, and later founder of Daimler Motoren Gesellschaft, the home of the German Mercedes car, patented a compound explosion engine with the hope of getting higher

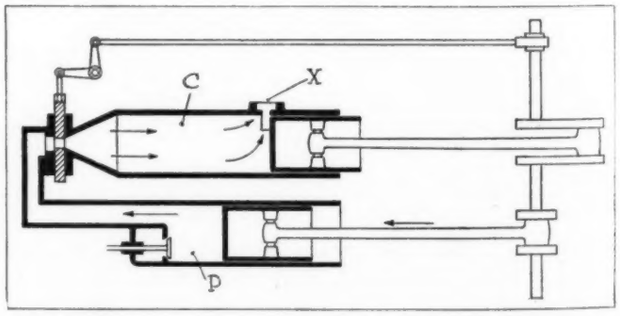


Fig. 1—Clerk's two-cylinder, two-cycle engine of 1878, which comprised a working cylinder C, in which the piston operated, and the pumping cylinder P which was used to force a charge of explosive mixture into the working cylinder. The mixture entered through a positively-controlled valve in the head of the cylinder, which was given a conical or hemispherical construction

efficiency than was obtained in the Otto type. Many to-day remember the compound explosion engine which was manufactured in this country for many years, the car being known as the Compound.

Daimler's patent on the Compound engine, dated Dec. 9, 1879, shows a design of three-cylinder engine, the cylinders arranged parallel. The two end cylinders were explosion types which received the explosive mixture and in which it was ignited. The middle cylinder was a low-pressure one, and in which no explosion occurred, but in which the expansion of the gases from the end cylinders was utilized to drive the piston downward and thus get more use from the explosion and increase the efficiency. The cycle of operations is thus described by Daimler:

"There occurs during each revolution of the crankshaft two impulses, the one being from the two high-pressure cylinders and the other from the low-pressure cylinder. The passage of the gaseous products from the high-pressure cylinders to the low-pressure cylinder can commence before the pistons and the former arrive at the extreme end of the out stroke; but the low pressure piston must at the same time have just arrived at the extreme end of its end stroke."

Not Commercially Practical

Daimler's patent contains a symptom of doubt as to the practicability of the low-pressure cylinder in that the patent sets forth that the two high-pressure cylinders can be used without the low pressure one, in which case their products of combustion are discharged direct into the atmosphere. This form of motor showed an increase of 15 per cent in efficiency but never came into successful use due to the added weight and the complications it required.

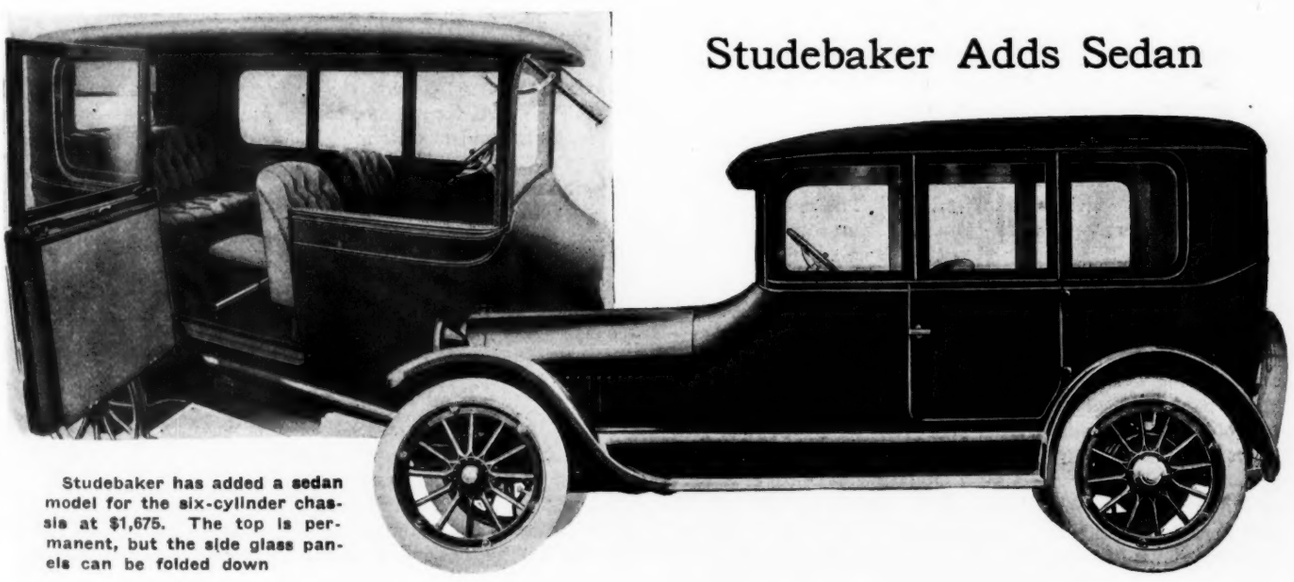
Selden Enters the Field

In America at this same time matters were developing that later were of great moment in the automobile industry. It was in May, 1879, that George B. Selden filed his application on his patent relating to an explosion engine and also an automobile which later brought about the celebrated Selden suit which was defeated by Henry Ford and others five years ago. It was the activity of Otto, Clerk, Gilles, Holton, Brayton and others that brought the importance of the explosion engine to the attention of Selden, who was a patent attorney. Selden's engine was built on the Brayton air-tank design and not on the Otto four-cycle, or the Clerk two-cycle principle.

Engine of the Brayton Type

With his brother, A. R. Selden, he had discussed horseless carriages while visiting the Centennial Exposition in 1876 at Philadelphia, at which place he saw the Brayton engine and talked with Brayton. In the latter part of 1877, he did some work on a small brass model engine and in the spring of 1878, got out drawings and had a crankshaft forged for his three-cylinder engine of the Brayton type. He seems to have recognized the necessity of light weight and compact arrangement and as compared with Brayton engines built for stationary or boat use, his conception was superior, even though in many respects faulty. He made no provision for waterjackets but claimed to cool by introducing water into the crankcase, a method that when accidentally tried by modern gas engine users has customarily caused trouble. He applied for his patent in May, 1879, and slowly fought it through the Patent Office, taking frequently the permitted two years between actions which was his legal right. When the case was finally ready for issue, he prepared a smooth copy for the office which contained some changes not properly belonging therein but which apparently passed unnoticed by the office. His patent was issued in November, 1895, after the industry had developed to a practical point without his aid, as demonstrated by the Chicago contest of that month.

Studebaker Adds Sedan



Studebaker has added a sedan model for the six-cylinder chassis at $1,675. The top is permanent, but the side glass panels can be folded down

The Rostrum

Suggests Screening Air Intake

EDITOR THE AUTOMOBILE:—I take the liberty of writing you on a subject which seems to have escaped the majority of manufacturers of carbureters. I will ask you a question and give you one answer. Although I know there may be several answers to the question, I think mine deserves consideration.

Where do scored cylinders originate?

Answer—Through the air intake of the carbureter through which is drawn all the dust and dirt which comes within the radius of the suction, and I think you will agree with me that a considerable amount of dust and dirt accumulates around the engine. I think it would be a good thing if a proper screen were provided on the air intake, to prevent the dirt from being drawn into the cylinders and made easily accessible for cleaning purposes.

Montreal, Que. J. B.

Inadvisable to Enlarge Valves

Editor THE AUTOMOBILE:—I wish to increase my compression to 100 lb. How much can I plane off my cylinder head and how much will I have to raise my pistons?

2—How much can I enlarge my valves without coming too close to the waterjacket?

Chicago, Ill. W. S.

—It is impossible to tell you how much to reduce the volume of your combustion chamber to reach 100 lb. compression without knowing what the original volume is or how much the bore of the cylinder is. The method of procedure, however, which you can follow to work out the problem for yourself is as follows: Multiply the compression pressure by the volume of your present combustion chamber and divide it by 100 to secure the total volume of the new combustion chamber.

For example: If your present compression is 70 lb. and the volume of the combustion chamber is 20 cu. in. to have a compression of 100 lb. the volume of the combustion space would have to be $\frac{70 \times 20}{100}$ or 14 cu. in.

2—It is inadvisable to enlarge them at all.

Timing Pope-Hartford for Speed

Editor THE AUTOMOBILE:—We have a model T 1909 Pope-Hartford motor which we have rebuilt. The cylinders have been rebored from 4 5/16 to 4⅜ and it has 5½ stroke with racing pistons. It is equipped with a Bosch magneto. Will you please tell us how to time the cams and ignition so as to get the most speed and power?

Oneonta, N. Y. ONEONTA GARAGE CO.

—To work out a racing timing is a matter of experiment as the timing not only depends on the general design of the engine itself but also on the conditions that obtain in the manifolds. It is assumed from your questions that it is your idea to have this engine operating at high speeds and in that case an early exhaust opening and a late intake closure coupled with high compression will probably be the scheme under which you will work. It might be well to start with an intake opening at top center and intake closure at about 20 deg. past lower center. Exhaust opening 45 deg. before bottom center and closing 10 deg. after top center. The ignition should be carried as far in advance as possible without having a knock. This is done by advancing the magneto one tooth on the timing gears so that your advance is carried forward as far as possible.

Diagrams of Electric Systems

Editor THE AUTOMOBILE:—Kindly publish diagrams of the North East systems for former Metz and Marmon four and six cars?

2—Are the Jesco, Adlake, and Rushmore systems being made this year?

3—Would like to see the circuit diagrams of the Owen Magnetic car and its transmission.

4—How should roller clutches be lubricated? Is any one way of lubrication better than another?

5—How many elements enter into the function of spark advance? Lag of current, combustion, etc.? Theoretically, is the position of piston exactly the same at low speeds as at high speeds after allowing for lag of current, process of combustion, etc., and is this position at or near top of center?

Weymouth, Mass. H. R. B.

—The diagrams you request of the North East systems for Metz and Marmon cars are shown in Fig. 1.

2—Yes.

3—The circuits of the Owen Magnetic car are as follows:

A—Charging position means, starting and lighting battery being charged by generator through engine running. Car stationary.

B—Starting, generator connected in series with starting and lighting battery, generator acting as a motor.

C—Neutral, car stationary with engine running. When car is coasting motor becomes an electric brake controlling car to maximum 15 m.p.h.

D—First speed. Generator and motor in series resistance shunt across generator field.

E—Second speed. Generator and motor in series. No resistance.

F—Third, fourth and fifth speed. Generator and motor in series resistance shunted across motor field.

G—Sixth speed. Generator short circuited on itself. Motor independent from generator circuits acts as a generator for charging battery.

4—The clutch must be lubricated once every week with high grade engine oil injected in the oil openings.

5—Yes. The nearer explosion occurs to top dead center position of the piston the better. It is only to allow for the relative lag that spark is advanced at higher speed.

Fuel Leak Cuts Lubricant

Editor THE AUTOMOBILE:—The discovery of a new condition in the oiling system of gasoline motors we believe is of sufficient importance to warn all users of automobiles to-day, to be on the lookout for this trouble. The existence of this condition, after careful study, has been determined to be caused by condensation of a part of the gasoline which will not ex-

plode when the motor is cold or immediately after having been started on a cold morning.

The present low gasoline contains a large amount of kerosene and less volatile oils. This passing into the motor while it is cold, passes the rings and the pistons and apparently condenses and mixes with the oil in the crankcase. Such a condition will naturally thin down the oil until it lacks all of its lubricating qualities, and if this condition is allowed to continue it will eventually ruin the motor. This is particularly noticeable in motors where the drivers are in the habit of using them for a few miles at a time, and is especially noticed in small towns in the country where it is a short distance to and from the various places of business, when the motor never gets hot enough to assist in evaporating the heavy gasoline procurable at the present time.

Oil Becomes Very Thin

The first symptom of this condition is the apparent economy of oil at the oil level, which remains at a standstill or shows a tendency to rise. In some cases it is necessary to drain the oil from time to time to keep the oil level from causing the motor to smoke. It will be found in draining this oil that it is very thin and in some places equivalent to kerosene.

Careful attention and the frequent draining of oil anywhere from 500 to 1000 miles, and replacing with fresh oil during cold weather is the only thing that will guarantee the user against an injured motor from this cause. The writer has been in the automobile business for the past fourteen years and has never known this condition to exist such as it is now, and believes that it is a public benefit to warn all motorists to be on the lookout for this trouble, which is so easily avoided.

Numerous complaints of fouled motors, even though they have been used but a few hundred miles, have come to my attention, motors which before this condition had arrived had never given any trouble in the accumulation of excessive carbon in the combustion chamber, and we have found this condition to exist in motors of practically every type.

Changing Oil in Vain

The average garage man and the average motorist immediately blames the oil. Then he tries another brand of oil and it does the same, and he shifts again and divides the responsibility between the oil and the car until the cold weather is over and things right themselves.

The reason for this I shall not pretend to determine. Possibly in the mad effort to make three gallons grow where before there was but one, may be the answer. Apparently the lower distillates are so broken up that it all passes for gasoline long enough to be sold as such, but in the engine on a cold morning, you may just as well try burning a mixture of gasoline and kerosene.

Anyway, watch your oil. Drain a half pint of oil out of the bottom of your crankcase and see for yourself.

ANDREW AUBLE, Pres. Akron Auto Garage Co.
Akron, Ohio.

Correct Timing of Chandler

Editor THE AUTOMOBILE:—What is the timing of a Chandler sixteen?

2—What are the meanings of the markings on the flywheel of the Chandler sixteen?

3—What is the price of the Landis shock absorber as illustrated in THE AUTOMOBILE, Chicago show number, and also the address of the manufacturer?

4—What is meant by a cam which is variable at different speeds? What is the profile of such a one like?

Malone, N. Y. F. J. D.

—The firing order of the Chandler motor is 1-5-3-5-2-4. The inlet valves are 2-4-6-8-10-12; the exhaust valves are 1-3-5-7-9-11. The exhaust valve closes 1⅝ in. past dead

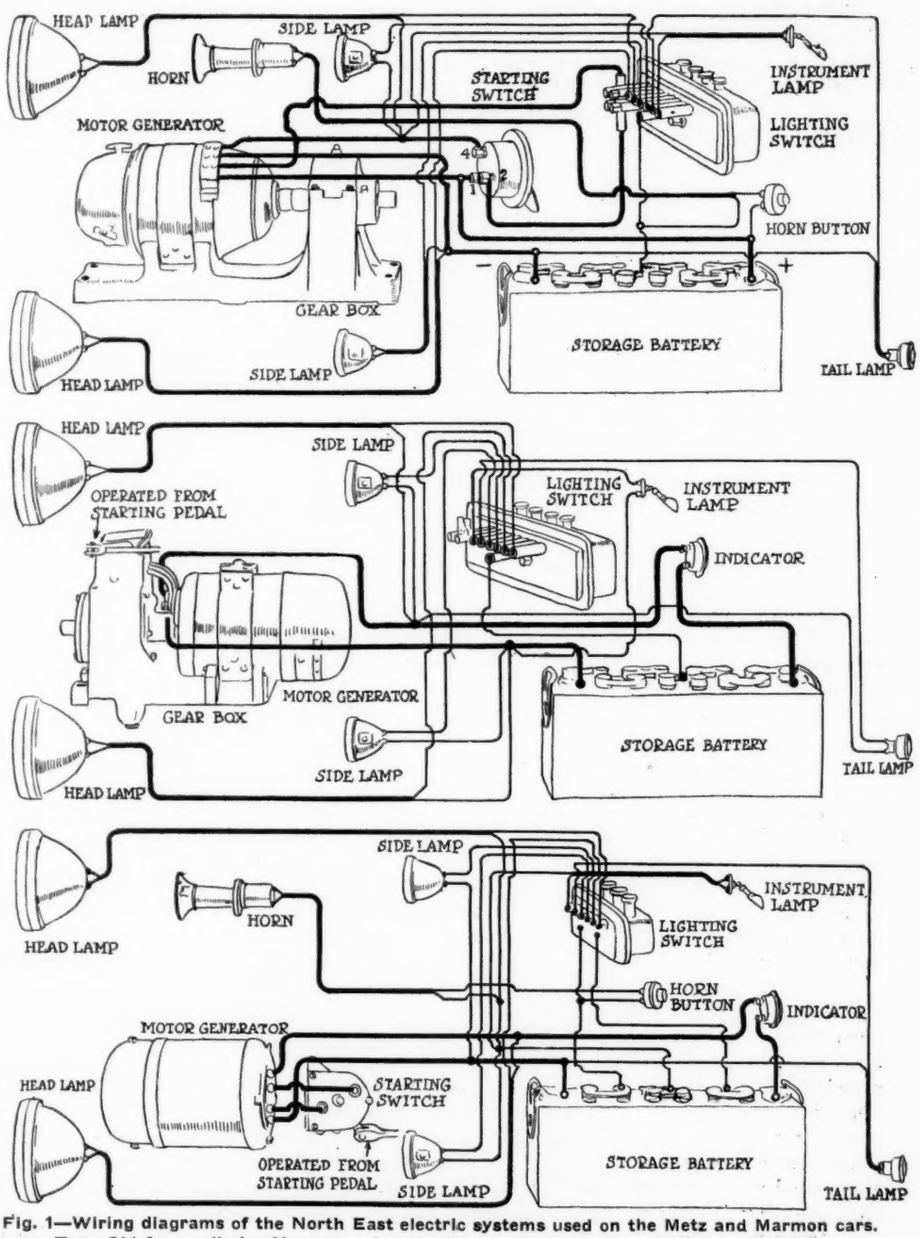


Fig. 1—Wiring diagrams of the North East electric systems used on the Metz and Marmon cars. Top—Old four-cylinder Marmon. Center—Former Marmon six. Bottom—1914 Metz

center on the suction stroke. The inlet valve opens 1⅞ in. past dead center on the suction stroke.

2—The flywheel is marked, as is the top of the flywheel housing at the filler plug. When the marks on the flywheel and case are opposite one another, No. 1 piston is at top center. With the valves closed the clearance between the valve plungers and valve stems should be 0.004 in. and for best results should be set when motor is hot.

3—The price of the Landis shock absorber is $30 a pair, or $60 for a set of four. This shock absorber is manufactured by the Landis Engineering & Mfg. Co., Waynesboro, Pa.

4—Presumably you mean a cam which can be varied by manual shifting. Such a cam has one profile at one end and another at the other, being made perhaps three or four times as wide as the roller which it operates. The profile changes slowly so that by sliding the camshaft the different portions of the cam can be brought underneath the roller and so different valve timings are obtained.

Lost Motion in Steering Gear

Editor THE AUTOMOBILE:—The steering wheel of my Chevrolet Royal Mail has about 3 in. of lost motion, and there is no reason for this, as the car is a new machine and has been run only about 2000 miles.

2—Is it practical to mix gasoline and kerosene, and burn same in a Chevrolet?

3—What are the advantages and what proportion will give the best results?

Back Bay, Va. J. L. G.

—The best way to take up the lost motion would be to remove the Pitman arm, revolve the gears one-half way around to a new position, as there are no provisions made on this steering gear for an eccentric adjustment, as is found on some types of steering gears. Again this lost motion might be helped some by adjusting the adjusting nut, which is found at the upper end of the steering gear housing to its furthest position in, without binding. This adjustment is for the up and down movement of the steering column, which would have a great deal to do with the lost motion of the wheel.

2—We would not advise mixing kerosene and gasoline, as the carbureter furnished is a strictly gasoline type, and with the low grade of gasoline now being produced with a mixture of kerosene would certainly cause a lot of carbon deposits. This is a trouble that we all like to eliminate, if possible, as it takes a motor expert to disassemble the overhead valve construction and remove the head in order to clean out this carbon which has deposited.

3—These proportions can only be settled by experiment.

Cleaning Fluid for Motor Parts

Editor THE AUTOMOBILE:—Please give me information regarding the potash kettle for cleaning motor parts on dismantling a motor for machine shop use and the proper mixture for use in the kettle. I am told sal-soda will do the same thing. I tried it without much success and it turned aluminum black. There is a demand for a cleaning mixture other than gasoline.

Harvey, N. D. R. M.

—The cleaning fluid which you desire will naturally depend upon the metal to be cleaned. Since you mention aluminum, it is probable that the information wanted covers aluminum cleaning, and a formula for making this fluid is simply a solution of 30 grams of borax in 1 liter of water containing a few drops of ammonia water. To remove discoloration use a solution of one heaping teaspoonful of oxalic acid crystals to one gallon of warm water. Leave the part standing in this solution over night and then clean it thoroughly with water.

A strong soda solution for cleaning grease from machinery and metal parts can be made by taking 10 to 15 grams of caustic soda or 100 grams of soda for each leader of water. This solution should be applied boiling hot and the parts, if not too large, should be dipped into the solution. All that has to be done after this is simply rinse and dry the parts thoroughly.

Hydrometer vs. Voltmeter

Editor THE AUTOMOBILE:—I would like to have you answer through your columns whether it is more accurate to use a hydrometer syringe or a voltmeter to get the results of the life in a storage battery. In the garage where I store and in a number of battery service stations I find that the majority use the hydrometer for testing and will say that the battery is all right. I have been troubled with my starter and the service men say that my battery is at fault, so I have taken the battery to a number of stations but they can find nothing the matter with it. An electrical man I was talking to told me to put on a voltmeter when I put the starter on. I tried this and found that the voltage dropped to about 4½ and stayed there for a few minutes and then gradually came back to the 6½ volts. Can you tell me the reason for this and also to satisfy some of my friends' curiosity as to which is the most reliable for testing the real juice in a storage battery? J. C. W.

Detroit, Mich.

—The hydrometer will tell you one thing and the voltmeter another in examining the condition of a battery. The hydrometer tells you the specific gravity of the electrolyte which must be within certain limits in order for the battery to function properly. If a hydrometer shows between 1.275 and 1.3 when the battery is fully charged the electrolyte is in proper condition. However, it is quite possible for the electrolyte to be in good condition and the battery to show a low voltage on the meter because the plates may be broken down or some other internal trouble not giving the full voltage.

Regarding the particular trouble you mention in which you applied a voltmeter and found that the voltage went to 4½ and stayed there a few minutes and then gradually came back to 6½, it looks as if the trouble were more in the voltmeter than in the battery because the potential would not increase by putting a voltmeter across the terminals. A sticking voltmeter hand was probably the cause of this apparent contradiction.

Pressure Required to Close Brakes

Editor THE AUTOMOBILE:—What is the approximate pull in pounds necessary to operate the service and emergency brakes, direct without any levers, on a medium weight touring car? Also the difference in the perimeter of the two brakes when expanded and contracted and vice versa, or otherwise the brake displacement in fully applying the brakes.

Springfield, Mass. C. M. E.

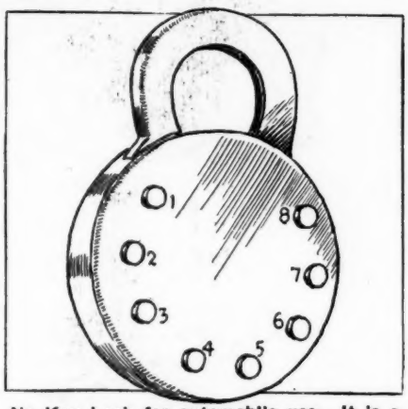
—This varies through such a range that it is impossible to give any definite figures. It is also difficult to determine whether you mean that the brake is locked on the wheel or whether just applied gently. It may be stated, however, that an application pressure of 20 lb. should firmly close the brakes.

The difference in perimeter of the two brakes when expanded and contracted and vice versa is simply the difference between the internal and external diameters of the brake drum. Since you do not mention the size drum you refer to it is again impossible to give you a definite figure, but taking a standard 14-in. drum external diameter having a thickness of ¼ in., the difference in diameter between the inner and outer circle would be ½ in. and the difference in circumference would be one-half of 3.1416 or 1.57 in.

ACCESSORIES

No-Key Auto Lock

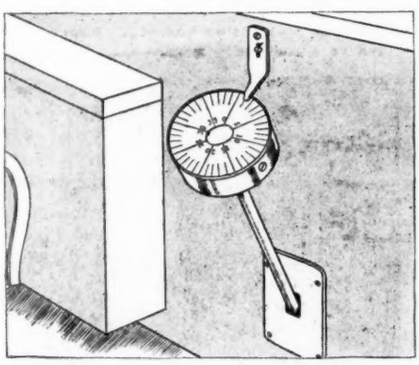
AS its name implies, this lock does not require the use of a key, being constructed on the combination principle so that a gentle pressure on certain of the eight buttons shown in the illustration as called for by the combination of each particular lock opens the hasp. There are 40,000 combinations possible so that no two are alike. With this lock there is no danger of a thief picking it open, no trouble or expense due to the loss or duplication of keys, no trouble in opening it in the dark. The combination may be changed as often as desired and there is no danger of the lock getting out of order. Some of the buttons push down and some up and the lock may easily be operated with one hand. It is made of brass and bronze and is consequently very durable. There is no iron or steel about the lock to rust and impair its operation. The locks are useful for protecting garages, cars, toolboxes, spare tires, and all sorts of general purposes. Packed in an individual carton, one lock weighs 5¼ oz. Price, $1.50—Manufacturer, American Keyless Lock Co., Chicago, Ill.; Kapp Specialty Sales Co., New York City, distributor.



No-Key Lock for automobile use. It is a combination type using buttons

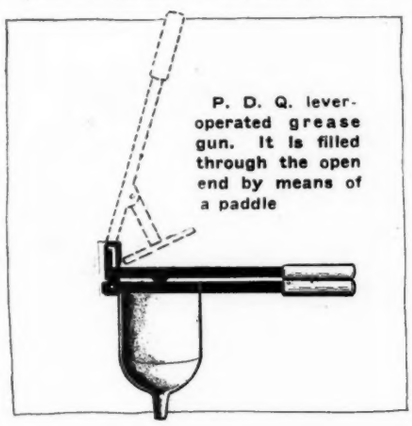
Schoener Carbureter Adjuster

This adjustment for the Ford carbureter is connected by a rod to a dial on the dashboard. The dial is graduated and the graduations are numbered so that when the mixture is changed it can always be brought back to the original position. The device sells for 50 cents.—Schoener Mfg. Co., St. Cloud, Minn.


Schoener carbureter adjuster for Fords

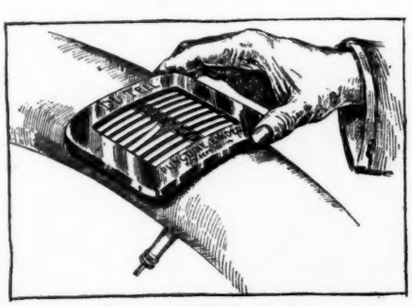
P. D. Q. Grease Gun

The barrel of this gun is of large diameter and has a conical end and tapered nozzle. The plunger is hinged to a handle which is jointed to swing on a link attached to the top of the gun, and a second handle is attached to the barrel. The gun is filled through the open end by means of a paddle, and the process of expelling the grease is like squeezing a lemon. The gun is quickly loaded and quickly emptied; the large open barrel makes it a simple matter to get in a full charge without smearing grease on the outside. Price, $2.50.—Star Brass Works Co., Kansas City, Mo.


P. D. Q. lever-operated grease gun. It is filled through the open end by means of a paddle

Du-Tell Puncture Finder

This is a light metal casing, not much larger than a good-sized cigarette-case, with a transparent window on one side and open on the other, contains a number of strips of very thin cork, arranged in two rows; the strips are free to move to a limited extent. The device is used by passing the open side over the punctured tube, close to it. When the escaping air impinges on the cork strips they are made to move, instantly locating the hole. The cork will move under a stream of air that cannot be felt by the wet hand. The device sells for 50 cents.—J. W. Anderson, New York City.


Du-Tell puncture locating device

Glargon Electric Bulb

The feature of this bulb is that about one-half of the bulb surface is silvered so that the rays are reflected and thus prevent glare; no rays leave the headlight at an angle above the horizontal.—Greenwood Mfg. Co., East Templeton, Mass.

Limousette for Fords

This attachment is placed on the windshield for the purpose of closing the space between it and the top, thus excluding cold and rain. It lists at $1.50—Lion Buggy Co., Cincinnati, Ohio.

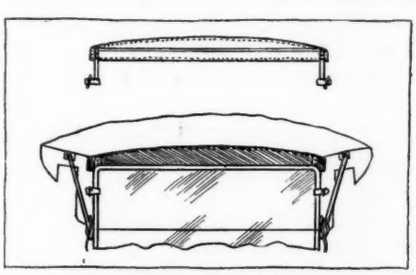
Re-Ac Auto Heater

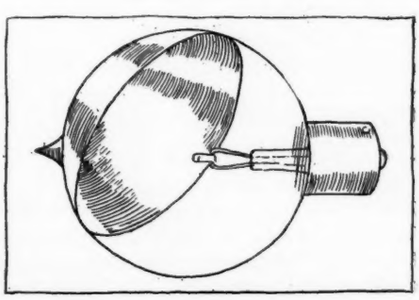
A hot air car heater has recently been put on the market under the name of the Re-Ac. It is a simple device consisting of a stove for the exhaust pipe, a register permitting a flow of hot air into the car, a hose connecting the tube and a valve for regulating the amount of heat flow.

The hot air stove is readily clamped in position on the exhaust pipe and the register is mounted flush with the floorboards. The valve can be pushed by the toe to any degree of opening desired. The device sells for $10 complete.—The Re-Ac Co., Newcastle, Pa.

Ever-Ready Polish

The maker states that this metal polish is suitable for all finished metal surfaces,


Limousette attachment for Fords


Glargon non-blinding lamp bulb

hard or soft, that it leaves no sediment, is non-greasy and requires little rubbing. It is put up in cans in the form of a cream.

The Ever-Ready carbon remover, another product, is put up in cans, each can containing sufficient liquid to decarbonize three average motors. The makers point to the fact that it is put up in sheet-iron cans, tinned, as proof of its harmlessness to iron. The polish sells for 35 cents per can and the carbon remover for $2.50 per can.—Every-Ready Mfg. Co., St. Louis, Mo.

Buckbee Self-Adjusting Bearing

Means for automatically taking up wear are provided in the Buckbee Self-Adjusting bearing for crankshafts and connecting-rod big ends. It is particularly adapted to the connecting-rods, and utilizes the principle of contracting on the shaft as wear occurs.

One of the illustrations shows a connecting-rod fitted with this new type of plain bearing, while the other gives the details of how the outer surface of the cap bushing is inclined and fitted with wedge-shaped segments, the combination acting to automatically set up the bushing to compensate for wear.

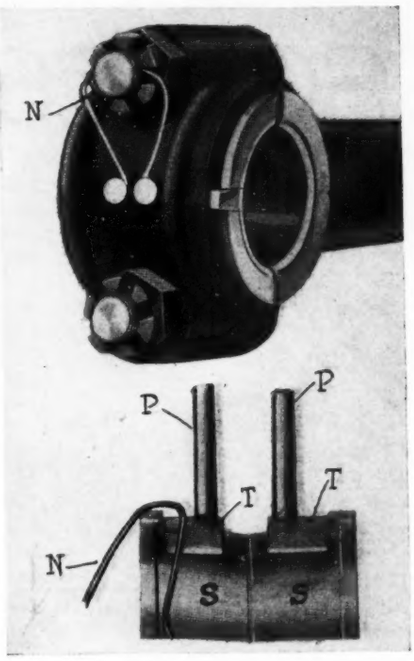
The result is accomplished by forming the bushing of two halves, each half being slightly less than one-half the diameter of the shaft, so that they are spaced slightly apart when in place on the shaft. This is to allow for the automatic take-up as the wear occurs.

The part of the bushing carried by the cap member is provided with two cone-shaped surfaces disposed at opposite angles, as shown at *S*. Fitting these surfaces and also the inner surface of the cap member are two similar segments *T* wedge-shaped in cross section and each fitted with a pin *P*. These pins extend through a slot in the cap. A spring *N* attached in some way to the rod end is so looped that one end engages each pin and thus tends to force the wedges up the inclined faces of the bushing. This movement of the wedges forces the cap part of the bushing toward the other part and thus takes up any wear.

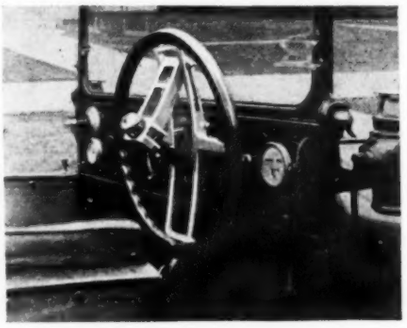
At each end the bushings are flanged to prevent any longitudinal movement in the box, and rotation is prevented by a pin in the usual way. This special type of bearing can obviously be attached to any engine having plain bearings, with very little trouble. Practically the only mechanical change is the cutting of a slot in the bearing cap.—Self-Adjusting Bearing Co., Detroit, Mich.

Clear-Room Steering Wheel

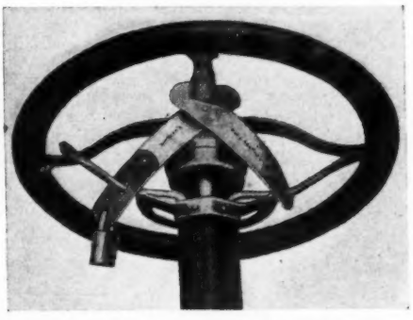
The driver has plenty of room to get in and out of his seat when this wheel is folded; a lock is provided which holds the wheel in either position. Model A is designed for cars with the spark and throttle levers under the steering wheel, and Model B is for cars with the levers over the wheel. Price, Model A, for Fords, 16 in., plain rim, ebony finish, $5.75; 17 in., for Fords, corrugated rim, walnut finish, $6; 17-in., standard type, corrugated rim, walnut finish, $6.50. Model B, corrugated rim, walnut finish, 17 in., $9; 18 in., corrugated rim, walnut finish, $9.50.—Vincent Clear-Room Steering Wheel Co., Detroit, Mich.



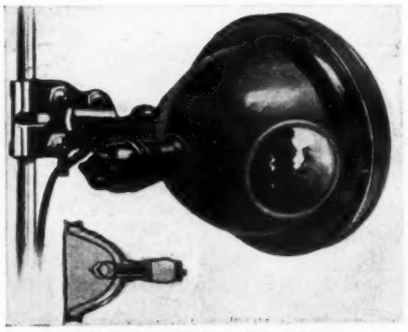
Buckbee self-adjusting bearing. Above—Fitted to a rod end. Below—Cap bushing



Clear-Room folding steering wheel



Koehler's Bulldog lock for Fords



Old Sol spotlight with mirror

Bulldog Lever Lock

This lock for Fords consists of a set of jointed steel arms which hold the steering wheel, the throttle and the spark lever rigidly in one position when locked. A jaw is formed which grips one spoke of the wheel, while the arms extend to the two levers and are held by a padlock which is supplied with the device. Price, $1.—Koehler Mfg. Co., St. Louis, Mo.

Old Sol Spotlight

This light is for reading road signs at night, etc., and is clamped to the side of the windshield within easy reach of the driver. It is supported on a universal joint which allows it to move in any direction. The universal is constructed so that it will not rattle. There is an on and off control on the end of the handle which is at the back of the lamp, so that the light may be used with greatest ease. A focusing device is located just forward of the control switch, where it is ready for instant manipulation. There is a mirror on the back for daytime use which shows what is behind. All models have silver-plated reflectors, 6-volt and 15-c.p. bulbs. The lamps are enameled black. Price, $4.50 for 6 in., $6 for 7 in., and $7 for same light, including pilot light. Tungsten bulbs, 25 cents extra.—Buckeye Motor & Cycle Co., Akron, Ohio.

Auto-Lac Top Dressing

This is a black liquid for top dressing and lining dye. It is applicable to all kinds of top fabric and will restore the silk luster and dull original mohair finish to the lining. The preparation sells for $4.50 per gallon can and $1.25 per quart can.—Auto Top Co., Portland, Ore.

Smooth-on Radiator Cement

Leaky radiators are quickly repaired by this cement. The contents of the can will mend up a radiator having a capacity of 4 gal. of water. The can of cement is mixed with sufficient water to form a thin paste and is poured into the radiator while the motor is running; the motor must run until the water is well heated before putting in the cement. The motor is allowed to run until the leak stops, when the water is drained out and the radiator allowed to stand for a short time before refilling with fresh water. If the leak is a bad one the cement is kept in the radiator for a day before draining it off. Price per can, 50 cents.—Smooth-on Mfg. Co., Jersey City, N. J.

The Automobile

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Used Car Shows

THE thin edge of the wedge is just being entered in the solution of the used-car situation. A year ago the publication of the used-car market reports quoting actual sale prices of used cars started a movement that has gained much headway since then, the Chicago dealers fathering the movement. This spring another wedge is being entered in the used-car problem, namely, staging spring shows for used cars. One or two of these used-car shows have already been held, and now Chicago is contemplating holding one in May. The working out of these shows will be watched with particular interest, and it is hoped that by this means many of the used cars that have been reposing on upper floor storage spaces and in storage warehouses will be brought to the light of day again and perhaps pushed into the outer world. Much money has been tied up in used cars that have remained stagnant in some cases for many months, and often for more than a year. There should be no better season than the present to properly present these used cars to the public. Heretofore the used car has been considered a millstone. It should not be so. The used-car phase of the business is as legitimate as the new-car one. Chicago and other associations are to be congratulated on bringing up-to-date merchandising atmosphere into the used-car field.

Thermal Efficiency

FOR years past engineers of the older school, accustomed to the use of large engines where the work obtained from every pound of fuel has to be checked and rechecked, have regarded the automobile with some surprise. From the viewpoint of the engine builder who has to show so many horsepower hours per ton of fuel or lose his business, the automobile appears an utterly uncommercial machine.

The reason for this apparent disregard for the fuel efficiency of self-propelled vehicles has been that it has taken years of development to combine the requisite power with the desirable weight. Fuel cost has been so small a proportion of the total maintenance that weight and power became considerations of far greater importance. We have been wasteful of fuel in order to obtain other advantages gained by a rather prodigal expenditure of gasoline.

The use of a cheaper fuel has been an ideal; and it is a curiously happy coincidence that engines designed to give a better thermal efficiency with gasoline are, in general, much more adaptable to the use of kerosene, so in developing a kerosene engine it is more than probable that an engine of better efficiency will be discovered.

Thinking Electrically

IT is essential to-day to think electrically. This is particularly true with garagemen, with those operating machine shops and all other forms of repair depots where diseased electric starting, lighting and ignition systems are repaired. A few years ago, in diagnosing troubles in the automobile, it was primarily essential to think mechanically—that is, to visualize the mechanics of the machine. To-day we have to go a step further and, in addition to visualizing the mechanical systems of the car, also visualize the electrical systems. This latter stage means ability to think electrically.

Thinking electrically presupposes a clear conception of the elementary or first principles of electricity. It is impossible to think electrically without such knowledge. You cannot diagnose electrical troubles unless you know the alphabet of electricity. Perhaps one of the first letters in the electrical alphabet is the circle, the circuit as termed in electrical parlance. Electrical thinking must operate in the circle, starting at a point and coming back to that point. The physical path traveled may not be circular; it may be rectangular—in fact, everything except circular; yet the circular concept is there—you start at a point and you must come back to that point. There must be a complete physical path. That path cannot be broken in a single place without trouble. To detect the trouble you must follow the circular concept. It is the first stage in thinking electrically.

THE AUTOMOBILE starts this week a series on electric units in the car. This series includes an analysis of such systems. It takes up the ills and diseases that beset and tells how they can be corrected.

Automobile Manufacturers Form Co. To Produce Gasoline at Lower Prices

United Motor Fuel Corp. of Manhattan Will Also Supply Information Regarding Cost of Production—Will Safeguard Stock Against Anyone Securing Control

NEW YORK CITY, April 5—The most important result of the increasing agitation against excessive gasoline prices is the organization of automobile manufacturers into a company for the production of gasoline and also to supply complete cost information on gasoline production with a view to protecting the makers and users of automobiles, motor trucks and other users of the fuel. It is the United Motor Fuel Corp. of Manhattan which was formally incorporated at Albany yesterday with $25,000 capital. The company will distribute its stock throughout the whole country in such a way that it cannot possibly pass into the control of any competitive interest. The capital will eventually be increased from $5,000,000 to $10,000,000.

The directors of the United Motor Fuel Corp. of Manhattan are: S. A. Miles, manager of the New York and Chicago Automobile Shows; J. A. Royall, for many years identified with the production of gasoline; A. L. Prindle, C. H. Mapledoram, a lawyer with offices at 100 Broadway; E. L. Gluck, T. R. V. Fiske, E. W. Stettit, C. H. Adams, C. J. Elias, W. Sterin, A. T. Swords, W. Little, New York; H. Fobes, Ridgewood, N. J.; H. Carter, Plainfield, N. J., and J. C. Barr of Brooklyn.

Offers of Land, etc.

The new company will prospect, produce, act as jobber in crude oil, build refineries and develop a large selling organization. Alfred Reeves, general manager of the National Automobile Chamber of Commerce, Inc., who is in close touch with the promoters, states that they have received numerous offers of oil land, refineries, equipment, etc.

Before any active steps were taken exhaustive reports of the conditions surrounding the oil business were quietly prepared, with the result that the manufacturers evinced their willingness to test the theories advanced by the oil companies concerning the reasons for the high prices now prevailing and the further advances so frequently threatened. It was during the lengthy conferences held within the past few days between representative automobile manufacturers, officers of the N. A. C. C. and men of experience in the oil industry that the plan to form an organization which would produce results in the way of reducing the price of gasoline to the automobile and truck user was decided upon.

The purpose of the new company will be to produce gasoline, kerosene, lubricating oil and other products of petroleum, not necessarily for the purpose of injuring any business at present in operation but to demonstrate that gasoline can be profitably produced and sold at a price lower than that now prevailing.

"This," said Mr. Royall, "we regard as the only real remedy for existing conditions. We shall, at the very least, demonstrate that no further increase is necessary, and so protect the business of the automobile makers and their hundreds of millions of invested capital.

"From 1859, when Drake discovered oil in Pennsylvania, down to the present day, the oil business has been one of constant agitation and concern to people.

"Yet in all these years, with Government, State and other investigations actively concerned in providing a remedy to deal with it, none has been found.

Two Possible Remedies

"So the only remedy to apply is actual Government control, which is neither feasible nor desirable at this time, or the formation of a company owned, managed and operated in the interests of the whole people.

"This corporation, when it is finally launched, will include all interests outside of the oil interests; and in this latter designation I include the so-called 'competitive oil interests,' from which no relief can be expected. They are all founded upon the same selfish interest, and maintain prices rather than provide real competition to the business.

Other Industries Included

"This company," continued Mr. Royall, "will have upon its board of directors a large representation of the automobile and other allied industries, which, despite their hundreds of millions of invested capital, are now wholly without representation in business so vital to their present and future welfare. In addition to its board and managing directors it has been suggested that the company have an advisory board of at least 250 non-resident advisors, elected pro rata according to the population of the various States, who will act without compensation. In applying the remedy it is not the purpose to disturb the great oil industry by resorting to destructive methods of competition, nor to single it out for attack by any other method, but only to create a highly organized competitive company, operating for profit, with the highest ideals of business integrity in all of its dealings with the people and, further, to open the book of knowledge concerning the oil business."

Life Insurance for Makers

Mr. Miles, who has been in consultation with manufacturers and others, stated that in connecting himself with the new company he felt assured of their hearty co-operation. Declaring that the new company will really attempt to provide life insurance for the builders of automobiles, motor trucks, etc., Mr. Miles pointed to the fact that the consumers' cost is now at the rate of $157,248,000 per year more than in August, 1915. Supporting this contention, Mr. Miles pointed out that the production of gasoline last year, as reported by the Department of the Interior, was 41,600,000 barrels of 42 gal. each, or 1,747,200,000 gal. The price has gone up in some places 100 per cent and in few places less than 40 per cent. In twenty of the principal cities of the United States the average price of gasoline in August of last year was 12.46 cents per gallon. The latest reports indicate that the price in the same twenty cities is now 21.56. Calling the increase 9 cents per gallon, the above figure of $157,248,000 increase is obtained.

—

Perlman Buys Jackson Rim Co.—To Boost Output

NEW YORK CITY, April 5—The Perlman Rim Corp. has purchased the entire capital stock of the Jackson Rim Co., Jackson, Mich., and the transfer of the property will take place on April 10, after which date it will be called the Perlman Rim Corp. Jackson plant. The Perlman corporation will erect additional factory buildings and will increase the equipment to such an extent that within three months the plant will be producing 4000 sets of demountable rims per day, or at the rate of over 1,000,000 sets a year.

The Perlman organization is also concluding contracts with other rim manufacturers for quantities of rims which will be ample to meet the requirements of the car manufacturers, so that there should be no delay in production because of lack of demountable rims. Rims are also being made at the Mott Wheel Works, Utica, N. Y., the Perlman corporation controlling the rim plant of the Mott works.

Contract has been closed by the Perlman interests with the Willys-Overland Co., the largest user of demountable rims in the world, for its requirements during the remainder of the season, and contracts with other car manufacturers are being arranged on a satisfactory basis.

Used Car Show for Chicago

Trade Assn. To Hold First Exhibition in Coliseum May 8-15

NEW YORK CITY, April 5—The Chicago Automobile Trade Assn. has gone one step farther in solving the used car situation. On May 8 to 15, it will hold a used car show in the Coliseum in Chicago, sanction for which has just been given by the National Automobile Chamber of Commerce. This is the first used car show that has been staged on a large scale in this country.

E. G. Westlake, Henry Paulman and Edwin Grier compose the show committee. Mr. Westlake, who has been in New York, to-day has requested sanction from the N. A. C. C. and has returned to Chicago, where he is going ahead with the plans of the show.

About eighty dealers will be represented at the exhibition, which will be purely a Chicago affair. These will represent about 95 per cent of the dealers in that territory. According to plans no trucks, accessories or 1916 cars will be on exhibition. All cars that are sold may be taken out at night and other cars put in their places.

A public drawing for space will take place in the near future and the dealers will be charged 25 cents a square foot for space. Each dealer is expected to take 800 sq. ft. of space, thus bringing the charge to $200. This amount, however, is expected to be made up in rebates.

Admission will be either 50 or 25 cents. The dealers will receive their tickets at half rates. The building will be decorated with flags, and will be opened from 10 a. m. to 10 p. m.

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Freight Car Situation Improves But Shortage Continues

DETROIT, MICH., April 4—For the first time in several months, automobile traffic managers, railroad officials and others having something to do with the traffic matters in this city, reported a slight improvement in the freight car situation. Some say that this is due to better weather in the East, others claim that the publicity given to the matter of increasing demurrage rates from $1 to $2 has brought about quick action by many consignees and shippers in taking prompt delivery of shipments, thus releasing a large number of freight cars for further use. Still there are others who say that in New York, Boston, Philadelphia and other Eastern cities more actual activity has been shown during the past week in relieving the congested roads, than in many weeks.

Whatever the reasons for the better conditions are, the fact that several railroads have lifted existing embargoes is sufficient evidence that there has been a betterment.

During March, 75 per cent more freight cars entered and left Detroit than during the corresponding month in 1915. It is estimated that fully 40 per cent of all the carloads which left the city contained automobiles or automobile parts. Of the 75 per cent increase, more than 50 per cent is credited to the automobile industry.

Automobile manufacturers are reported to be offering high premiums for regular automobile freight cars.

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28,600 Carloads of Automobiles Shipped During March

NEW YORK CITY, April 5—Shipments of automobiles during March, 1916, were the biggest for that month that the automobile industry has ever known, amounting to 28,600, as compared with 17,192 in March, 1915 and 23,809 in February, 1916, the best previous record. Six thousand of these carloads were made in box cars, by taking off the fenders and covering with tarpaulin.

The shortage of freight cars is reported just as bad as ever by the National Automobile Chamber of Commerce, which held its monthly meeting to-day. At this meeting the Chamber voted the indorsement of the action taken by the New York Automobile Dealers' Assn. against examining and licensing all owners of automobiles, believing this measure would fall short of accomplishing what its advocates claimed it would do.

The Chamber also voted that the automobile industry should co-operate with H. E. Coffin, Chairman of the Production and Standardization Committee of the Naval Consulting Board, and with the U. S. Government, on a plan for mobilization of trucks for preparedness.

After the monthly meeting of the directors, the members present met to consider reports of the proceedings in the matter of the United Motor Fuel Corp. The manufacturers gave tangible evidence of enthusiastic co-operation and pledged additional financial support to the preliminary work of the company.

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58,329 Fords Built in March

DETROIT, MICH., April 4—In March, the Ford Motor Co., made 58,329 Ford cars. This is 14,450 more than in March, 1915, which was the record thus far for a month's output at the Ford. The total value of this year's March production was $24,176,535. The average daily output was 2243 cars. On March 25, the record for a day's output was established when 2768 cars were completed.

Three Makers Raise Car Prices

Anderson Electric, Chalmers and Pathfinder Announce Price Increases

NEW YORK CITY, April 3—Three more automobile makers announced price increases this week, making a total of eleven which have done so; three have made reductions.

The Chalmers Motor Car Co. has advanced the prices of the three models built on the new 6-30 chassis, effective April 15. The touring car and cabriolet will each be increased $40, making the former $1,090 and the latter $1,440; the price of the roadster will be raised $20 to $1,070. All of these figures are f.o.b. Detroit. The increased cost of materials is responsible for the higher prices.

The Pathfinder Co., Indianapolis, has raised the price of its twelve touring car, $275, effective April 15. The cloverleaf roadster is $425 higher.

The Anderson Electric Car Co., Detroit, is the first among the electric vehicle makers to announce an increase in the price of its cars. This increase will be $100 for each of the five models made by the company and will go into effect April 8.

A summary of the price changes since Jan. 1, 1916, follows:

INCREASE

Co.	New	Old
Chalmers 32B	$1,450	$1,350
35 roadster	1,070	1,050
35 touring	1,090	1,050
35 cabriolet	1,440	1,400
Anderson Electric cabriolet, 3-pass.	2,175	2,075
Brougham, 5-pass., front drive	2,350	2,250
Inclosed type, 4-pass.	2,275	2,175
Brougham, 5-pass., rear drive	2,325	2,225
Brougham, 5-pass., double drive.	2,375	2,275
Dort	665	650
Studebaker:		
Roadster four	850	825
7-pass. four	875	845
Landau roadster four	1,150	1,145
3-pass. six	1,060	1,025
7-pass. six.	1,085	1,050
Saxon six	815	785
Marmon:		
5-pass.	2,900	2,700
7-pass.	2,950	2,750
3- and 4-pass.	2,950	2,750
Buick six:		
Roadster	985	950
Touring	1,020	985
Empire four	935	895
Scripps-Booth four:		
Roadster	825	775
Stearns-Knight:		
L4 5-pass.	1,445	1,395
Eight, touring	2,100	2,050
Pathfinder Twelve:		
Touring	2,750	2,475
Roadster	2,900	2,475
Joliet Tractor:		
Bates Steel Mule	895	865
Avery Tractors:		
5-10 hp.	365	295
12-14 hp.	1,195	1,125
18-36 hp.	1,775	1,680
25-50 hp.	2,190	2,145
40-80 hp.	2,625	2,475

DECREASE

Maxwell (Canada):		
Touring	850	925
Roadster	830	900
Cole	1,595	1,785
Overland	695	750

Seven Divisions of S. A. E. Standards Committee Report Rapid Progress

Nomenclature, Miscellaneous, Engine and Transmission, Research Discuss Many Subjects—Many Important Topics Scheduled for General Meeting in Cleveland

NEW YORK, April 3—Last week was a busy one for the standardization work of the S. A. E., seven division meetings taking place in New York, Detroit and Buffalo. The main points in the work of the Electrical Equipment division which met on March 28 were dealt with in the last issue of THE AUTOMOBILE, and mention was also made of the proceedings of the nomenclature division. The truly immense task of finding names capable of universal application, for all the parts of a chassis is nearing conclusion, and it is practically certain that a complete dictionary of terms will be ready for presentation to the Society in June. There are now only quite a few portions to be completed, and it is judged that two more meetings of the division will be sufficient. Since active work was started only last summer the progress has been very rapid indeed, for the difficulty of the work is quite great.

Fuel-Economy Test Specification

At the meeting of the Research division held in Buffalo April 1, some eight hours were spent in working out a specification for testing automobiles for fuel economy. This division had previously prepared such a form and presented it to the last meeting of the Society in January, 1916, but it was then voted that the restrictions were insufficiently rigid and the matter was referred back for further consideration.

The idea of this work is to provide full instructions for testing and checking tests so that manufacturers or others can make fuel economy demonstrations on a standard basis, so that the results will be directly comparable. It was felt that the motorist desires to know as closely as possible what his own car may be expected to do rather than what can be done with a car of that make when economy is everything.

Must Be Speedway Test

Thus the division is going to recommend a very rigid test indeed. The specification will be discussed at the next general meeting of the whole standards committee which takes place on April 21, and will then come before the whole society on the summer trip in June. It is possible that the present recommendations may be modified, but there is little doubt that a test carried out along their lines would be conclusive.

After much discussion it was agreed that the test to have any standard value must be made upon a speedway, where conditions vary less than on any road. Next that it was not fair to allow just one speed to be chosen, as that would allow the carbureter to be adjusted for that particular speed. The following schedule is suggested:

M.p.h.	Distance	Time
10	10	1.00
15	10	0.40
20	10	0.30
25	10	0.24
30	10	0.20
40	10	0.15
50	10	0.12
Total	70	2.41

Each run is to be repeated in the opposite direction, that is, two runs at 10 m.p.h. will be made, then two at 15 m.p.h. and so on.

When all the gasoline consumption runs have been made there must be an acceleration test, the results of which must be entered on the test form together with the consumption figures; this being to guard against the use of phenomenally weak mixture.

There are many other restrictions. For instance, it is laid down that the cooling system must be fully operative, meaning that the radiator must be full, that the fan must be running and no blanketing of the radiator will be allowed. Once set, the mixture must not be altered throughout the whole test, including the test for acceleration.

Fuel Tank Arrangement

The division recommends a particular arrangement of fuel tanks for the test, consisting of two special tanks carried on the back of the windshield. Of these one is weighed before the start of each stage of the test and the other is used for intermediate running, an arrangement of two cocks, allowing the switch from one to another to be made instantly. It was decided to recommend weight measurement, as this is so much more simple and accurate than volume measurement. All tests are to be made with gravity feed on a definite head.

There are many other details, directed toward the prevention of evasion of the spirit of the test. The rules are so rigid, in fact, that no false results could be shown as long as the observation and checking were carried out properly.

Electric Units' Mounting

On March 30 the engine and transmission division met in Detroit and opened proceedings by appointing members to serve on a joint sub-committee with representatives already chosen by the electrical equipment division, to discuss the possibility of setting up standards for the mounting of ignition units, generators and starting motors. Next the subject of V-belt proportions was considered and it was reported by W. R. Strickland that, while British practice was already almost standard, there was no sort of agreement among American firms, either automobile manufacturers or belt makers. After a long discussion it was decided to take steps to have a number of tests made to decide the best angle for the pulley groove and the best proportions for belts. The chairman of the standards committee, A. Ludlow Clayden, undertook to try to arrange for a test to commence shortly. Practically every British user has adopted a 28-deg. angle for V-belting, but American types vary from 35 up to 60 deg.

W. T. Fishleigh, chairman of the division, then presented a number of blueprints of engine characteristics prepared, some by manufacturers and some by Professor Fishleigh himself in the laboratories of Michigan University. This division does not expect to make any report to the general meeting in Cleveland on April 21, but meets there April 22.

Curves for Groove Depth

March 31 was spent in active session by the miscellaneous division, which has a great number of subjects before it. The two principal items of the day were agreement upon a drive connection for speedometers, which will be submitted at Cleveland, and a further consideration of piston ring dimensions. The widths of rings for pistons of various diameters had already been decided, and there remained the determination of the proper depths for ring grooves in the piston.

The recorder to the Standards Committee had plotted some curves for groove depth in accordance with a suggested formula, and the latter was modified somewhat so as to increase the depth for small sizes while scarcely affecting that for the larger. On steering wheel sizes, the chairman, J. G. Utz, reported that the only part of a wheel suitable for standardization is the hub or center, where it is bored for attachment to the steering column. It is neither possible nor desirable to attempt to standardize the rim or spokes of the wheel. The following is the list of subjects now before the miscellaneous division in the order of importance:

1. Speedometer drive connections
2. Piston ring groove dimensions
3. Gearshift positions
4. Steering wheel hub dimensions
5. Taper sockets for fender supports
6. Heavy duty rod ends (wider than the existing standard)
7. Fillister, countersunk, round, French and carriage head bolts
8. Length of thread on S.A.E. standard bolts
9. A.S.M.E. pitches for small screws
10. Thread tolerance
11. Lock washer pressure.

Several other suggested subjects were

discussed and a recommendation to the Council passed that these other subjects be left alone for the present.

On April 4 the truck standards division met in New York with the purpose of clearing the slate of a number of small matters. A variety of subjects which had been suggested as suitable for the consideration of this division were discussed and most of them considered too unpromising for present treatment. The trailer hitch which seemed a good subject was found to be too complicated with patent devices. It was decided to postpone action on sections for solid tires in order to see how closely the standards for wheel diameter will be adhered to.

The most important matter now before the division, concerning which investigation is being made is that of control for trucks. European mobilization of motor trucks has shown that the military value of standardized control is incalculable. Gear lever positions ought always to correspond, brakes should have similar locations, throttle levers should always move in the same direction for opening, and so forth.

After several set-backs it now appears that there is hope for the establishment of a rating for solid and pneumatic tires which will help a truck manufacturer to choose the best size of the tire to give the lowest possible cost per mile. Some suggested tables were drawn up and are to be circulated among the tire makers for their consideration and amendment.

Ball Thrust Bearings

April 5 was taken by the ball and roller bearings division for a discussion on the standardization of thrust bearings, which follows naturally upon the work already done with the radial bearings. This work consists of a careful examination of practice and it is hoped to be able to complete it within a comparatively short space of time.

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Wertman, of McGraw Tire, Promoted

NEW YORK CITY, April 1—C. E. Wertman, formerly assistant branch manager of the McGraw Tire & Rubber Co., this city, has been promoted to the position of resident manager, succeeding R. F. Hobron. E. E. Cowan has been appointed to the position of sales manager of the New York territory.

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Tests on Sylphon Thermostat

WORCESTER, MASS., April 1—Tests made at the Worcester Polytechnic Institute on the Sylphon circulation regulator made by the Fulton Co., Knoxville, Tenn., and used on two prominent multi-cylinder cars have been completed. These tests from reports received would tend to show that the use of the regulator, which incorporates a thermostatic control of a by-pass valve, results in an increased fuel economy.

Variable Cutoff Is Suggested

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Hoosier Engineers Discuss Higher Compression and Increased Thermal Efficiency

INDIANAPOLIS, IND., March 31—Increasing the compression and controlling power by variable intake cutoff were discussed as possible means of increasing the thermal efficiency of automobile engines at the meeting of the Indiana section of the Society of Automobile Engineers, held at the Claypool Hotel this evening. This discussion was the result of the statements made by C. E. Sargent, chief engineer Lyons-Atlas Co., in the paper of the evening, Increasing the Thermal Efficiency of Automobile Engines, which appeared in THE AUTOMOBILE for March 30. Mr. Sargent, who has had long experience with the Diesel type of high-compression engine and with gas engines of large sizes, is particularly fitted to discuss the advantages and disadvantages of higher compression than is used in motor car engines.

In his paper Mr. Sargent's remarks were based upon the fact that the average good internal combustion engine has been never much greater than 20 per cent efficient. This means that only one-fifth of the actual power possibilities in the fuel has been turned into useful work in this type of engine. His remarks were directed toward the development of engine design which would decrease some of the 80 per cent heat loss in friction, cooling water, radiation and exhaust. He offered for consideration the idea of varying the cutoff rather than the throttle to produce changes in engine speed and power. By this is meant changing the time at which the inlet valve closes instead of changing the amount of opening of the throttle.

Points Worth Study

It seemed to be the consensus of opinion of the engineers present that the points brought up by Mr. Sargent's paper were worth study from a theoretical standpoint, and embodied more a theory whose results might be worked toward rather than a practical basis for engine design at the present day. Among the engineers who took part in this phase of the discussion were, J. G. Vincent, Packard; Howard Marmon, Nordyke & Marmon; A. P. Brush, Brush Engineering Corp.; John O. Heinze, Heinze Electric Co.; Chester Ricker; Eugene Gruenewald, Moline; Mr. Grimes, National, and R. H. Combs, Prest-O-Lite.

Mr. Heinze stated that the engineers were aiming to maintain the same high compression and develop the same high efficiency of fuel economy at all speeds and at all power production. In other words the ideal is to permit flexibility and power without sacrificing thermal efficiency.

Mr. Sargent explained that the reason for closing the inlet valve late was in the attempt to get all possible fuel efficiency out of the motor, the effort being to make the motor as efficient under low loads as under high loads.

Mr. Heinze mentioned a motor which he developed two years ago arranged so that the time of closing of the intake valve—that is the cutoff—could be varied by having split cams. It was found that by varying the cutoff in this way it was possible to get as high as 19 per cent thermal efficiency, but not maximum power. In order to obtain the maximum power the thermal efficiency had to drop to about 16 per cent, that is, at 28 and 30 hp. the efficiency was 16 and at 25 it was 19.

Chairman F. E. Moscovics mentioned an English engine of several years ago which had a variable cutoff, and also stated that one of the old Wintons had a variable pressure maintained by using an air cylinder which operated in connection with the intake valve.

Chester Ricker explained that that valve was purely automatic, a light spring just sufficient to lift the valve was so connected with a piston in the air cylinder that it increased the air pressure on the intake.

A Cutoff Engine

Mr. Sargent stated the gist of his paper when he said "what we want to get is a cutoff engine."

Mr. Gruenewald stated his belief that any increases which could be obtained in this way in the thermal efficiency of an engine by changing the cutoff would not be sufficient in the minds of owners to make up for the increased complication.

Mr. Combs stated in a formal paper the point was made that 11,000 volts are necessary to overcome the pressure of 90 lb. per square inch. To this Heinze replied that not only the voltage is to be considered, it is also the current. It takes a pressure of 40,000 volts to puncture a glass plate ⅛-in. thick providing there is plenty of current behind it, but magneto current at 40,000 volts would not do it. He stated it was his belief that magnetos could be made which would spark in 200 or 300 lb. compression if needed.

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Splitdorf-Apelco $10 Higher

NEWARK, N. J., April 3—An increase in price for the Splitdorf-Apelco electric starting and lighting system for Ford cars has been put into effect by the Splitdorf Electrical Co., the new price of $75 being an increase of $10. Higher cost of raw materials is solely responsible for the increase, according to the company.

Day-Elder to Build Trucks

$100,000 Concern Will Make 1-Ton and ½-Ton Models in Newark

NEWARK, N. J., April 1.—The Day-Elder Motors Co., this city, has been formed to manufacture motor trucks. The company is headed by Charles P. Day, for the last six years with the Universal Tobacco Machinery Co., Newark. G. A. Gemmer, the inventor of the Gemmer steering gear and who assisted in the organization of the Gemmer Mfg. Co., Detroit, is vice-president of the new company. F. G. Elder is treasurer. He has been an advertising man during most of his business career, having for the past nine years been treasurer of Sherman & Bryan, Inc., advertising agents in New York City. The new concern has been incorporated under the laws of New Jersey and is capitalized at $100,000.

The plant will be located at 161-167 Ogden Street, and will be occupied about April 15.

A 1-ton and a ½-ton model will be manufactured, the tonner selling around $1,400 and the other model at $850. These prices are at present only tentative, however, as no prices have as yet been definitely fixed.

The 1-ton truck will be equipped with a Continental four-cylinder motor developing 19½ hp. Other features are Bush radiator, Detroit Gear & Machine Co. transmission, and Sheldon front axle and springs.

The ½-tonner will use a Le Roi motor, developing 16 hp. Other features are a Grant-Lees transmission, Sheldon worm-drive rear axle, and Sheldon front axle and springs. This model will also be equipped with a starter.

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Stroup Paige Purchasing Agent

DETROIT, MICH., March 29—P. E. Stroup has been appointed purchasing agent of the Paige-Detroit Motor Car Co. He held a similar position with Dodge Bros. during the last three years.

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Sohlinger Flint Varnish Sales Manager

FLINT, MICH., March 30—W. J. Sohlinger, who during fourteen years was connected with the Sherwin-Williams Co., varnish maker in Cleveland, is now sales manager of the Flint Varnish & Color Works.

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Von Rosen Is Saxon Sec.-Treas.

DETROIT, MICH., April 1—E. E. von Rosen, well known in the automobile industry, has been elected a director and also secretary-treasurer of the Saxon Motor Car Co., L. R. Scafe, formerly secretary-treasurer, having resigned. Mr. von Rosen was formerly comptroller of the United States Motor Co., and during the last three years was assistant comptroller, general auditor and assistant treasurer of the Maxwell Motor Co.

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McCulla in Mexico Assisting Army

DETROIT, MICH., April 1—Wm. R. McCulla has left this city for Mexico to assist the government on mechanical and aerial transport. Mr. McCulla has had experience in the European war, having spent ten months in the war fronts on the other side.

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Leonard Is Ferro Vice-President

CLEVELAND, OHIO, April 1—H. N. Leonard, who has been general sales manager of the Ferro Machine and Foundry Co., this city, was recently elected to the position of vice-president and general manager of the company.

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Beane Is Mattson Representative

LODI, N. J., March 30—R. S. Beane, for many years associated with tire companies, has formed a connection with the Mattson Rubber Co., this city, Mr. Beane will be this company's special representative and will begin interviewing the larger dealers at once. The Mattson company reports a greatly increased activity, the plant now running three shifts.

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Hopewell, of Chase & Co., Dies

BOSTON, MASS., March 31—John Hopewell, since 1870 a member of the firm of L. C. Chase & Co., manufacturers and commission merchants, this city, died this week in Washington, D. C. The Chase company manufactures, among other things, artificial leather for upholstery and other purposes. Mr. Hopewell was born in Greenfield, Mass., Feb. 2, 1845.

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Corman Joins Elgin Co.

DETROIT, MICH., April 3—E. W. Corman, recently advertising manager of the Saxon Motor Car Corp., has joined the Elgin Motor Car Co., Chicago, in the capacity of director of sales and advertising.

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Selden Is Scripps-Booth Asst. Mgr.

DETROIT, MICH., April 1—C. H. Booth, the president, has taken over the general managership of the Scripps-Booth Co., this city. C. G. Selden has been appointed assistant general manager. C. A. Erickson, who was formerly chief draftsman of the company, has been promoted to the office of chief engineer.

Chevrolet Plant for Ft. Worth

$600,000 Assembling Plant To Complete 15,000 Cars Per Year

FORT WORTH, TEX., April 1—The Chevrolet Motor Co. will build a $600,000 assembling plant in Fort Worth. The plant, which is to be chartered with a capitalization of $600,000, will cover approximately three acres of floorspace and will employ from 300 to 500 persons to begin with. The initial capacity will be 15,000 cars per year.

The building is to be constructed entirely of concrete and brick. The directors of the corporation will be Samuel Davidson, W. C. Stripling and N. H. Lassiter.

The Chevrolet company will also have assembling plants in Oakland, Cal.; Atlanta, Ga.; Minneapolis, Minn., and Kansas City, Kan. These are at present being established. The company now has plants in Flint, Mich.; Oshawa, Ont.; New York City, Tarrytown and St. Louis, Mo.

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Packard's March Truck Business Amounts to $1,000,000

DETROIT, MICH., April 1—Orders calling for trucks to the value of $1,000,529.75 are on the books of the Packard Motor Car Co., showing the results of its domestic truck business for March. More than 99 per cent of the amount was for truck chassis; a majority of the buyers ordered bodies built by outside concerns. The company has delivered 4,308 Twin Six cars.

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Hyatt Roller Bearing Co. to Equip New Process Steel Mill

LANCASTER, PA., April 1—An agreement has been filed in the courthouse at Lancaster, Pa., in which the Hyatt Roller Bearing Co. proposes to equip a mill there costing $50,000, for the New Process Steel Co., on the outskirts of the town. It is agreed that in return the Hyatt company will receive the products of the steel concern until the amount has been covered.

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Sellon Chevrolet Supervisor

NEW YORK CITY, April 4—W. A. Sellon, for the past three years branch manager of the Brooklyn branch of the Chevrolet Motor Co., has been appointed retail store supervisor by that company. He will have charge of all the retail branches operated by the Chevrolet company and will be under the supervision of M. B. Leahy, factory sales manager.

Prest-O-Lite Completes Addition

New Building Will Increase Total Production to 1200 Batteries Per Day

INDIANAPOLIS, IND., April 1—An addition to the main factory of the Prest-O-Lite Co., 100 by 400 ft., which is the second largest building of the present factory group, is practically complete and will permit a total production of 1200 Prest-O-Lite storage batteries per day, three times the amount of the present output. The building is one story of reinforced concrete construction. Floors in one-half of the structure are of brick so as not to be affected by the action of acids. The roof is of reinforced concrete with a layer of cork under the roofing as an insulation against the sun's heat. Floor drains have been located at intervals of about 20 ft., and hose outlets provided at frequent intervals. Washing sinks will be placed at frequent intervals throughout the building and provided with mixing faucets so arranged that employees will wash in warm, running water.

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Freight Hold-Up of Rubber Closes Knight Tire Plant

CANTON, OHIO, March 30—The Knight Tire & Rubber Co. has announced that it will be compelled to shut down, owing to the failure to obtain rubber from New York because of the freight congestion. About 125 cars are tied up in the East. About 500 men are affected.

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Builds All-Steel Bodies

FREEPORT, ILL., April 1—The Stover Steel Tank Co., Freeport, has embarked upon a new side line, building all-steel bodies for commercial motor vehicles, no wood whatsoever being used in the construction. The Ford commercial all-steel body is made entirely from one piece of steel, with the exception of the hinged end-gate, and, under this form of construction, the makers entirely eliminate metallic sounds from riveted joints. In addition, the company is making all-steel express and stake bodies, ranging from the smallest to the five-ton trucks.

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Streator Sale Brings $25,000

STREATOR, ILL., March 31—The real estate and buildings of the Streator Motor Car Co., now occupied by the Barley Mfg. Co., were sold at public auction by S. C. Eastman, referee in bankruptcy, for $25,000 to the Barley Mfg. Co. and the Streator Metal Stamping Co., the latter desiring to occupy a portion of the plant. The property consists of several modern buildings, has two switching tracks and 7 acres of land. The buildings and real estate have been used for several years by the Barley company, renting from the receiver. The stamping company has also been a tenant. The Barley company will continue to manufacture automobiles and supplies. The plant originally cost $75,000 and was installed by the defunct Streator Motor Car Co.

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Overland Ships 47,465 Cars in Three Months

TOLEDO, OHIO, April 1—In the three months ended March 31, the Willys-Overland Co. manufactured and shipped a total of 47,465 cars, a new high record. This total comes within 1000 cars of equaling the entire yearly output of 1914. Output in March was 19,780, compared with 7005 in March, 1915, a gain of 12,775.

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Jordan Plant for Cleveland

CLEVELAND, OHIO, March 31—A plant will be erected in this city for the Jordan Motor Car Co. A 5-acre site has been purchased on East 152nd Street, south of St. Clair Avenue. Ground will be broken at once. Cost will be $50,000.

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Baltimore Tire Acquires Plant

BALTIMORE, MD., April 3—The Baltimore Rubber Tire Mfg. Co., this city, acquired a plant April 1 and will be ready to turn out its product on July 1. The plant will be located at Orangeville, the former home of the Maryland Mantel & Tile Co., and the group of buildings acquired is ideal for the manufacture of tires and inner tubes.

The capital stock of the new company is $200,000, all common. The company eventually expects to employ between 500 and 600 men, and the officers are G. W. Habbersatt, president; H. M. Rover, secretary-treasurer, and A. S. Mauk, vice-president and general manager. Mr. Mauk holds patents on several well-known tires. He has been identified with some of the leading rubber tire plants in the country.

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Chevrolet Takes Cycle Co. Capacity

NEW YOPK CITY, April 1.—The Chevrolet Motor Co. has entered into an arrangement with the National Cycle & Mfg. Co., Bay City, Mich., to control its capacity for an indefinite period. The National Cycle & Mfg. Co. owns two plants, covering 5½ acres, is equipped to build motors and parts and employs from 1500 to 2000 men.

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Wolverine Car and Tractor Organized

DETROIT, MICH., March 30—The Wolverine Car & Tractor Co. has been incorporated here with a capital stock of $300,000 by William J. and T. J. McNamara and William J. Wagenhals.

Night Work Lowers Efficiency

Study of Work and Output Shows Day Workers' Record Is 40% Better

SYRACUSE, N. Y., March 30—That workmen in factories on night shifts are 40 per cent less efficient than those working on day shifts is the conclusion of George D. Babcock, production manager of the H. H. Franklin Mfg. Co., this city. Mr. Babcock, after studying the efficiency of night factory forces, concludes that even with greatly increased supervision per man and with special incentives for night work, such as 10 cents extra per hour to the night men, it is impossible to get from the night forces more than 75 per cent of the efficiency obtained from the day shift. Mr. Babcock has further discovered that while the output efficiency of night work is much lower, the regularity of workmen is reduced and the amount of rejected work is much greater at night than in the day. This situation is not entirely due to artificial lighting or to less satisfactory shop conditions, but principally to the lack of willingness of first-class workmen to work nights, and to an increased fatigue on account of carelessness in the hours of rest and sleep. The daily hours of sleep are not so regular with a person on night work as with one on day work. Mr. Babcock believes that sleeping during the day develops nervousness which tends toward restlessness.

Tests at Other Plants

That the efficiency of a workman is not so great at night has been demonstrated at other factories. In one Cleveland factory the test made some years ago showed that the output of a day force dropped off materially when the electric lights were switched on at four o'clock on the winter afternoons. The electric current for the machinery and also for the lights was drawn from the same switch board and it was found that the consumption of current after the lights were turned on was actually a little less than before. This can only be explained by the fact that the men were not working at the same capacity and the different machines were considerably below their average output.

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Chalmers to Assemble in Oakland

OAKLAND, CAL., April 3—The Chalmers Motor Co., Detroit, will erect an assembling plant in this city. It will employ from 300 to 400 men at the start and turn out twenty-five to thirty cars a day. The announcement was made before the Chamber of Commerce at a luncheon given for Hugh Chalmers.

No Packards for 1916 Races

Will Appear on Speedways But Not in Competition—Test Aeroplane Motors

DETROIT, MICH., April 3.—There have been a great many rumors concerning the probability of the appearance on the speedways this year of Packard racing cars. It is now finally settled that while such cars will undoubtedly appear no Packards will be entered for any competitive racing during 1916. For several months past the Packard engineers have been engaged upon the design of aeroplane engines, and J. G. Vincent proposed to follow the example of the Mercedes company, which tried out its aeroplane motor by fitting it in a racing chassis.

Recent European experience goes to show that no engine is better suited to aeroplane requirements than the twelve-cylinder and the Packard experiments will therefore be along the line of finding out the power and weight limitations of this type of engine. Experiments probably will be made with several different sizes ranging from about 300 cu. in. upward.

Preliminary tests on the block have been very encouraging, and there seems no doubt that the smallest experimental twelve will be capable of driving a chassis at a very high speed.

Want Rickenbacher on Coast

CHICAGO, ILL., March 27—Eddie Rickenbacher, manager of the Prest-O-Lite racing team, may be a contender in the Corona grand prize, April 8, and in the Ascot meet, April 16. Rickenbacher states he has been offered the Bentel Mercer for both events, and has been informed by George Bentel that the car is in perfect shape. He will accept the offer if his work at Indianapolis will permit it.

300-Cu.-In. Milac Building

LOS ANGELES, CAL., March 31—The Linthwaite-Hussy Motor Co., of this city, builder of the Milac car of 199 cu. in. piston displacement which Teddy Tetzlaff drove in the Ascot speedway event March 5, is building another Milac on the same lines which will just come under the 300-cu. in. regulations. This second car is to be driven in the Corona Grand Prix April 8, and then be shipped East to compete in the Indianapolis classic.

Anderson May Be Independent

INDIANAPOLIS, IND., March 27—Gil Anderson, champion speedway driver, probably will be the manager of the new Stutz team of racing cars for the 1916 season. It is reported that Anderson is negotiating with Harry Stutz for the use of the three white cars which he managed last year. Whether or not the withdrawal of Stutz from racing last year will prevent the use of the cars under independent management has not been determined.

Of the four Stutz cars in the team last year, one is now being raced in California by Earl Cooper. Anderson hopes to take the other three, in which case Tom Rooney will be a second driver. The third has not as yet been decided upon.

Sixteen Entries to Date for Corona Grand Prize

CORONA, CAL., April 2—Sixteen entries have been made so far for the Corona boulevard race on April 8. The first official practice on the course is to be held to-morrow afternoon. Two informal practices have been held in which some of the drivers entered in the Corona Grand Prize turned some fast laps.

During an informal practice spin, yesterday, Hughie Hughes on his first trial on the Sunbeam 12, turned a lap at 106 m.p.h. Earl Cooper on the Stutz made a lap at the rate of 97.7 m.p.h. O'Donnell on the Duesenberg showed 95 m.p.h. in his first try-out with the drivers.

Car	Driver	Car	Driver
Delage	Oldfield	Sunbeam	Hughes
Peugeot	Burman	Edwards	Edwards
Milac	Tetzlaff	Cyclone	Durant
Onar	Toft	Mercer	Thomas
Apperson	Price	Gandy Sp.	Waterman
Mercer	Pullen	Gandy	Lou Gandy
Stutz	Cooper	Marmon	Welsh
Duesenb'rg.	O'Donnell	Tahis	Teel

Seven Chicago Amateur Entries

CHICAGO, ILL., April 3—With the Chicago amateur driver's race over six weeks away there are twenty-five entries promised and seven actual entries for the event. Those who have actually signed the entry blanks and deposited the fee are as follows:

Driver	Car	Club
F. C. Sawyer	Mercer	South Shore Country Club.
William Leet	Mercer	Omaha Automobile Club.
Dr. R. R. Duff	Mercer	Central District Mfg. Club.
H. W. Mershback	Packard	Chicago Automobile Club.
C. H. Robbins	Mercer	Speedway Park Association.
William Robbins	Mercer	South Shore Country Club.
E. C. Church	Cadillac	Chicago Automobile Club.
Frank Warner	Cadillac	Chicago Automobile Club.
Bronsted	Mercer	Chicago Automobile Club.

Bourne Magnetic Truck Co. Formed

DOVER, DEL., March 30—The Bourne Magnetic Truck Co. has been formed in this State with a capital of $2,000,000 to manufacture and deal in motors, engines, wagons, etc. The incorporators are H. E. Latter, N. P. Coffin, C. M. Egner.

Christiaens to Race at Indianapolis

Will Drive Sunbeam—René Thomas Cannot Appear—Fiat Not to Enter

PARIS, April 3—*Special Cable*—Joseph Christiaens, the Belgian who drove the six-cylinder Excelsior into sixth place at Indianapolis two years ago, is an assured entrant with a six-cylinder Sunbeam in the 300-mile Indianapolis Speedway race, May 30. The report, however, that René Thomas, winner of the 500-mile race on the Indianapolis Speedway in 1914, will drive a Peugeot in that race, is incorrect. Though the Fiat company has been redesigning two 1914 Grand Prix models and it was almost certain the company would enter these in the coming Indianapolis race, it is now stated that this company has decided to the contrary.

To Convert Chicago Speedway Stock—Ben Hur Racers

CHICAGO, ILL., April 3—David F. Reid, president of the Speedway Park Association, has secured an option on all the common stock of the association, a move which will eventually release it from the hands of contractors who now hold all the outstanding shares. He states that the shares under option will be converted to membership certificates.

Attorneys for the association have recently incorporated a company with a capital of $100,000, headed by Mr. Reid, which will sponsor the Ben Hur special racing team to represent Chicago at all the big races. It is expected the new cars will be ready for the May races in New York and Indianapolis.

Patterson Heads C. A. C. Amateurs

CHICAGO, ILL., March 27—E. C. Patterson, former backer of Ralph De Palma, has been elected captain of the Chicago Automobile Club team for the invitation non-professional drivers' race at the Chicago Speedway, May 20. It is expected that there will be a large entry list from the local motoring organizations as well as from other clubs in the vicinity. The Rotary Club has named five entrants, and a number of the Chicago sportsmen were out for unofficial practice Saturday. Arrangements were made for official practice Sunday, but weather conditions did not permit it.

Master Drivers Run Annual Event

CHICAGO, ILL., April 4—The three-day reliability run for the master driver's medal, which was won last year by E. A. Turner, driving a Mercer, will be repeated this season, probably in October, and will be made an annual event.

New Financing Co. Formed

Guaranty Securities Corp. Plans to Finance Time Sales of 21 Makes

NEW YORK CITY, April 1—A new plan for financing time sales of automobiles which is not restricted to any one particular make, has been announced by the Guaranty Securities Corp., New York City, which is an outgrowth of the Guaranty Securities Co., Toledo, that was originally formed to finance time sales of Overland automobiles.

The plan as worked out by the new Guaranty Securities Corp. is very simple and consists simply in selling a man a car on a cash payment of from one-third to one-half the list price of the car and the balance in eight equal monthly payments or fewer installments if desired. To this is added in cash 2½ per cent of the list price to pay for necessary insurance and incidental expenses if the car lists at $600 or more, or 3 per cent if the selling price is under $600. The insurance is for full 80 per cent fire and theft coverage for one year.

At the present time the Guaranty plan has been extended so that the following cars may be sold by the dealer under its provisions: Ford, Hudson, Studebaker, Paige, Chevrolet, Reo, Oakland, Overland, Buick, Chandler, Maxwell, Kissel, Oldsmobile, Willys-Knight, Cadillac, Chalmers, Dodge, Jeffery, Hupmobile, Mitchell and Franklin. The credit concern intends to inaugurate a large national campaign to inform the general public of the plan, which will probably be widened in its scope as time goes on.

The customer gets the immediate use of his car and pays 6 per cent on the deferred payments. The schedule of payments for cars of different prices is given below:

SCHEDULE OF PAYMENTS

Price of Car	Cash Payment Required, % of List	Amt. Payable on Def. Payments, % of List
$ 750 or less	33⅓	66⅔
751 to $1,250	40	60
1,251 to 1,500	45	55
1,501 or more	50	50

The dealer pays no interest or premium, but when the customer has signed a contract in accordance with instructions given by the Guaranty concern, the dealer indorses it and sends it on to the credit house. The dealer keeps all the cash including the amount collected for insurance and incidental expenses. In addition to this the Guaranty Securities Corp. sends to the dealer immediately the amount of the deferred payments due from the customer, except the insurance and incidental collections and 20 per cent of the deferred payments. For this amount a deferred certificate is issued to the dealer, in which the Guaranty Securities concern agrees to pay the remaining 20 per cent as soon as the customer finishes paying for the car.

To show how this works out, the following is given:

Dealer sells a car listing at...	$1,000	
Dealer adds for insurance and incidental charges..... (2½% of list over $600).	25	
Customer pays down on car (40%)		$400
Customer pays down for insurance, etc.		25
Customer gives contract note for deferred payments, $75 per month for 8 months.....		600
	$1,025	$1,025
Guaranty Securities Corp. buys contract note at face value..		$600
Guaranty Securities Corp. holds cash on deferred certificate till payments on contract note are completed (20%)...		120
		$480
Guaranty Securities Corp. deducts cash received for insurance, etc., and retained by dealer		$25
Guaranty Securities Corp. pays dealer cash immediately....		$455
Customer pays dealer cash on delivery (as above).....		$425
Dealer receives immediately in cash		$880
Guaranty Securities Corp. redeems deferred certificate in cash when payments on contract note are completed....		$120
Dealer receives full list price..		$1,000

Tentative Program for Salesmanship Congress

DETROIT, MICH., April 4—Though the program that will be taken up at the World's Salesmanship Congress here, July 9 to 13, has not been finally decided, a tentative program has been prepared. Who all the speakers will be has not yet been fully decided. A large number of well-known men in the different industries of the country are eligible.

Some of the subjects suggested to be taken up are: Are Salesmen Born? Can Psychology Make Salesmen? What Does It Cost To Make a Salesman? Ethics of Salesmanship; Comprehensiveness of Salesmanship; Selection of Salesmen; Education of Salesmen; Direction of Salesmen; Salesmanship in Public Schools; Salesmanship in Universities; Salesmanship's Health; Real Estate Salesmanship; Insurance Salesmanship; Sureties Salesmanship; the Price-Cutting Manufacturer; the Discounting Jobber; the Bargain Sale Retailer; Sales Letters; Magazine and Newspaper Advertising; Premiums and Souvenirs; Selling to South America; Selling to Germany; Selling to Great Britain; Debate on the Question, Is Advertising Salesmanship?

New Charging Station Booklet Out

NEW YORK CITY, April 4—The New York Electric Vehicle Assn. has issued a new booklet with maps showing the charging stations, routes and giving data over the entire metropolitan area, including all of New Jersey.

Dealer Loses Broken Wheel Suit

Canadian Court Holds Him Responsible as Maker's Representative

MONTREAL, QUEBEC, March 31—According to a judgment rendered in the Court of Review yesterday by Justices Fortin, Guerin and Archer, the vendor of an automobile, when he is acting as agent for the manufacturers, is bound to assure himself that the machine is well constructed and in perfect order, according to the guarantee, as he may be held responsible under the law for any damages which result from defects in the automobile.

It was proved that a defective wheel in the automobile which formed the basis of the action caused the death of the purchaser, J. Philippe Pothier. His widow sued P. A. D. Robert, from whom her husband bought the automobile, for damages, and Justice Hutchison, in the Superior Court at Sherbrooke, awarded her $2,500 on this stated ground:

Rotten Wood Used

"That the proof establishes beyond doubt that the accident was due to the rotten condition of some of the spokes of the left hind wheel of the said car, which collapsed or smashed and broke away from the hub of the wheel, and which caused the car to overturn." Robert appealed from this judgment, but yesterday it was unanimously confirmed by the Court of Review. "This may not be very popular with makers and sellers of automobiles," remarked Justice Fortin, "but it is according to the law."

Justice Guerin said: "Were I a judge sitting with the powers of a police magistrate, and application were made to me for a warrant for the arrest of the manufacturer who put such rotten wood in the wheel of this automobile, charging him with manslaughter, I would sign the warrant. In selling such an automobile he was selling a machine in a condition that endangered life. So far as the manufacturer is concerned it was criminal. So far as the vendor is concerned, it was not a crime, but it was a fault for which he is liable for damages."

Justice Archer held that the negligence on the part of the manufacturer was "gross if not criminal," and while the responsibility of the vendor of the machine was not the same, he said the man was nevertheless remiss and liable for damages.

Maker Is to Blame

"There can be no doubt that if the automobile had been sold directly by the manufacturing company to Pothier the

company could have been held responsible in damages. I am also of the opinion that, as a general principle, an automobile merchant ought to be put on the same footing as the builder or manufacturer of the automobile. The vendor in the present action is something more than a salesman in the ordinarily accepted sense of that term. He said in his evidence that he was the agent of the company, and as such gave demonstrations in order to show to clients the superiority of the automobile he had for sale. He further told the court that he conducted tests before delivering the automobile in order to be assured that the machine was in good order, and the tests that he generally made were sufficient to establish if the wheels were in good condition. This enabled him to ascertain for himself the quality of the material used in construction and assure him in giving guarantees, as he did in the present case, that the automobile was in perfect order. Notwithstanding the fact that he gave such guarantee in this instance, he does not appear to have made such tests."

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Gemmer Increases Capital $200,000

DETROIT, MICH., March 30—The Gemmer Mfg. Co., manufacturer of steering gears, has increased its capital stock from $300,000 to $500,000. This concern's business has been increasing in such a way during the last few months that, notwithstanding enlargements of the plant which were made last year, the additions did not permit the increasing business to be taken care of as well as desired. For this reason further extensions will be made and the working force increased.

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Lozier Capital Now $700,000

CLEVELAND, OHIO, April 1—The H. A. Lozier Co. has increased its capital from $10,000 $700,000.

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Accessory Forgings Capital $50,000

DETROIT, MICH., March 30—The Accessory Forgings Co. has increased its capital stock from $10,000 to $50,000.

Cleveland Machine Co. Reorganized

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Ohio Corporation With $4,000,000 Capital Succeeds New Jersey Concern

CLEVELAND, OHIO, April 1—The Cleveland Automatic Machine Co., an Ohio corporation, has succeeded the company of the same name, which was a New Jersey corporation. The capital stock of the new company, which was originally placed at $1,000,000, has been increased to $4,000,000. The company has sold to William Solomon & Co. of New York and Secor & Bell of Toledo, Ohio, the $1,500,000 7 per cent preferred stock, par $100, and this will be offered to the public. The $2,500,000 common stock, it is stated, will not be publicly offered. The preferred stock is to be redeemed through a sinking fund which will be formed by the retention of 10 per cent of the net earnings, but this annual amount is to be not less than $50,000. The stock is callable at 115. The stock of the old company, all of one class, had always been closely held, but this marks the entrance of banking interests into the business.

The operation of the business remains in the hands of the old organization, whose officers are: President, A. L. Garford, Elyria, Ohio; vice-president and general manager, James Brophy; treasurer, H. M. Rich; secretary, George Cook Ford.

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Rubber Goods Net Earnings Amount to $2,037,744

NEW YORK CITY, April 1—The Rubber Goods Mfg. Co. for the year ended Dec. 31, 1915, showed net earnings of $2,037,744 as against $2,084,626 in 1914. Net profits amounted to $1,330,166 as against $2,193,220 in 1914.

The reports says: "While the sales of the company both in quantity and value were larger in 1915 than in 1914, the net earnings were less on account of special conditions in the tire department. These adverse conditions made themselves felt throughout the entire heavy buying season, but from September on and continuing until Jan. 1 of this year up to date a marked improvement has occurred in the tire department."

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Market Prices Steady

NEW YORK CITY, April 5—Market prices last week were somewhat steady. Aluminum and lead with 5-cent rises and a decline in crude rubber were the features of the market activities. Aluminum rose to 70 cents a pound, a new high mark, while lead reached $8.00 per 100 lb. Para rubber declined 1 cent a pound to 74, while the Ceylon latex grade dropped 3 cents to 88 cents. Liberal arrivals of crude rubber were reported from Brazil yesterday. Despite the numerous reports of an active trade in rubber goods manufacturers show little disposition to purchase.

Steel prices remained constant last week. Both Bessemer and open-hearth steels are quoting at $45 per ton. Copper is firm at 28½ cents a pound. Beams and channels rose to $2.68 per 100 lb. at a gain of 6 cents.

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Dividends Declared

Chicago Pneumatic Tool Co.; quarterly of 1 per cent on all stock at close of business April 15, payable April 25.

General Motors Co., regular quarterly of 5 per cent on common and 3½ per cent on preferred, payable May 1, to stock of record April 18.

Kelly-Springfield Tire Co.; quarterly of 4 per cent or $1 a share on common, payable May 1 to stock of record April 15.

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Vacuum Oil Declares 3 per Cent Extra Dividend

NEW YORK CITY, April 1—The Vacuum Oil Co. has declared an extra dividend of 2 per cent as well as the usual semi-annual payment of 3 per cent, payable May 15, to stockholders of record May 1. The annual statement showed that net earnings in 1915 had been equal to more than 40 per cent on the $15,000,000 outstanding shares. The income account shows net profits of $6,861,913 against $2,075,644 in 1914.

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6 Per Cent Dividend for Bowser Employees

SOUTH BEND, IND., April 3—It has been announced by the management of the S. F. Bowser Oil Tank & Pump Co., Fort Wayne, Ind., that all employees of the plant will receive a dividend of 6 per cent on their wages for the month of February. It was stated by President Bowser that the company is planning to issue to each employe an insurance policy of $1,000 and an age pension.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.65	.65	.65	.65	.65	.70	+ .05
Antimony	.44½	.44½	.44½	.44½	.44½	.44½	...
Beams & Channels, 100 lb.	2.62	2.62	2.62	2.68	2.68	2.68	+ .06
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	10.60	10.62	10.55	10.25	10.40	10.35	— .25
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb.	7.95	7.88	8.00	7.88	7.88	8.00	+ .05
Linseed Oil	.77	.77	.76	.76	.77	.77	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.75	.74½	.74½	.74½	.74	.74	— .01
Rubber, Ceylon, First Latex	.91	.90½	.89	.89	.88	.88	— .03
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb.	50.00	49.50	49.00	48.75	48.75	50.25	+ .25
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Chevrolet Features Securities

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Reaches 183 Compared with 85 in Oct.—Firestone Common Goes Up 20 Points

NEW YORK CITY, April 5—Chevrolet stock went up to 183 yesterday, compared with 85, at which the bankers offered the stock last October, representing an advance of over 100 per cent. This is the most rapid appreciation shown by any of the securities offered in recent years.

Maxwell and Goodrich Strong

Maxwell and Goodrich were very strong last week. Maxwell common, first and second preferred closed on Saturday with gains of 2¼, and 1¾ points, respectively. Maxwell and Studebaker have been the target of pool activities at various times during the past year, and it was rumored that a well-known speculator who has been absent from the floor of the exchange for some time and who returned on Monday was beginning a new campaign in these issues.

Goodrich, it is stated, will earn not less than 25 per cent on its common during 1916. It is understood that the February net of that company was 85 per cent ahead of the same months of last year.

Gasoline Not a Factor

So far the widely heralded crisis existing in the gasoline situation has not hurt the securities prices. Automobile stocks are being purchased on the theory that the Mexican affair is going to lead the American army far into the wilderness, where numerous automobiles and especially trucks will be needed. It is also believed that should real intervention follow and Mexico be occupied by a large American army, thousands of American business men will follow the army into the choice business sections of the country. They will need automobiles of all types because the railroads are not adequately developed.

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$3,000,000 Orders from Russia—Not War Sales

NEW YORK CITY, March 31—That the market for American-made automobiles in foreign countries was never better is shown in reports of orders now on hand by the large exporting houses in this city. One house, Gaston, Williams & Wigmore, alone has on its books orders for $3,000,000 worth of touring cars and trucks from dealers and merchants in Russia. None of this business is with the Russian Government, but represents the foreign demand for American automobiles by automobile users in Russia.

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Bock Bearing to Be Reorganized

TOLEDO, OHIO, April 1—Incorporation of the Bock Taper Roller Bearing Co. this week is the beginning of the reorganization of the Bock Bearing Co., West Toledo. The initial capital stock is $10,000, but this is preliminary to increasing the capital stock of the present company. C. E. B. Lamson, J. E. Dunipace and C. H. Clements are the principal incorporators.

King Holds Annual Speedfest

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Host to Parts Manufacturers and Their Representatives —Business Talk Barred

DETROIT, MICH., April 1—A large number of parts makers and their representatives were the guests to-night of the King Motor Car Co., at the third annual King Speedfest, at Hotel Statler.

The purpose of this annual gathering is to get better acquainted. The unusual conditions prevailing in the automobile industry owing to the great war, the shortage of materials, the freight car situation, and the many other things which make the situation entirely abnormal this year, brought about many an interchange of views among the many men representative of the industry in general, although business talks were barred.

Some Materials Less Scarce

From what the parts makers had to say it appears that, while the general condition of the materials situation is still as bad as it has been for many months, the scarcity of certain raw products is not quite so pronounced. The parts makers are in the same situation as the car makers, inasmuch as they are able to get certain supplies of raw materials without too much trouble, while other needed supplies are very difficult to secure, even at the greatly increased prices which are quoted at present.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	69¼	70¼	+ ¾
Aluminum Castings pfd	98	..	..	..	..
J. I. Case pfd	76	85	85	87½	+10
Chalmers Motor Co. com.	83	85	155	160	—3
Chalmers Motor Co. pfd	90	93	98	101	—1
Chevrolet Motor Co.	..	..	170	175	—6
Electric Storage Battery Co.	47¾	48¼	62	64	+2
Firestone Tire & Rubber Co. com.	400	405	765	..	+20
Firestone Tire & Rubber Co. pfd.	110	112	113	115	..
General Motors Co. com	124	126	460	480	—20
General Motors Co. pfd	102½	103	114	117	+1
B. F. Goodrich Co. com	42⅜	42⅝	76⅛	76½	+3⅜
B. F. Goodrich Co. pfd	99	100½	114½	115½	+ ½
Goodyear Tire & Rubber Co. com	200	205	337	340	—3
Goodyear Tire & Rubber Co. pfd	103½	105	115	117	+3
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	5	8	18	20	—2
International Motor Co. pfd	18	22	35	40	..
Kelly-Springfield Tire Co. com	129	131	75⅛	75½	+ ⅞
Kelly-Springfield Tire Co. 1st pfd	83¾	84½	96	98	..
Kelly-Springfield Tire Co. 2d pfd	130	132	..	..	..
Maxwell Motor Co. com	44¼	44½	72¼	72½	+2¼
Maxwell Motor Co. 1st pfd	81½	82	86	87	+1
Maxwell Motor Co. 2d pfd	38½	39	55¾	56¼	+1¾
Miller Rubber Co. com	165	170	235	240	..
Miller Rubber Co. pfd	101	103	112	116	..
New Departure Mfg. Co. com	139	144	175	178	..
New Departure Mfg. Co. pfd	105	†..	111	..	..
Packard Motor Car Co. com	80	92	163	170	+3
Packard Motor Car Co. pfd	93¾	97½	100	104	..
Paige-Detroit Motor Car	..	..	690	..	..
Peerless Motor & Truck Corp.	..	..	25½	26½	— ½
Portage Rubber Co. com	30	34	70	72	..
Portage Rubber Co. pfd	84	85	106	108	..
Regal Motor Co. pfd	..	..	10	16	..
*Reo Motor Truck Co.	11	12	26½	27½	+ ½
*Reo Motor Car Co.	28½	29½	34⅜	34¾	+ ¾
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	57	58	86	88	—1
Stewart-Warner Speed. Corp. pfd	102	105	109	..	..
Studebaker Corp. com	59⅜	59½	141½	142½	+ ½
Studebaker Corp. pfd	98½	99½	111	113	..
Swinehart Tire & Rubber Co.	74½	76½	88	90	..
Texas Co.	138	139	195	197	..
U. S. Rubber Co. com	65	65¼	50⅝	50⅞	—1⅝
U. S. Rubber Co. pfd	105¼	105¾	109½	110½	+ ½
Vacuum Oil Co.	199	201	230	240	+7
White Motor Co. (new)	..	..	49½	50	—1½
Willys-Overland Co. com	123¾	124	224	226	—5
Willys-Overland Co. pfd	100½	101½	102	104	—2

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co.	..	..	31	32¼	..
Chalmers Motor Co. com	..	80	..	162	— 4
Chalmers Motor Co. pref	90	92½	97	100	..
Continental Motor Co. com	..	185	37¾	39	+ 3¾
Continental Motor Co. pfd	80	85	9½	10¼	— ¼
Ford Motor Co. of Canada	550	..	..	415	+ 20
General Motors Co. com	117	..	440	480	— 25
General Motors Co. pfd	99	100	113½	116	— ½
Maxwell Motor Co. com	33	34½	70½	73½	+ 2
Maxwell Motor Co. 1st pfd	75	77	83½	86½	— 1
Maxwell Motor Co. 2d pfd	30½	32	53	56	..
Packard Motor Car Co. com	80	92	165	173	— 1½
Packard Motor Car Co. pfd	93¾	97½	..	104	..
Paige-Detroit Motor Car Co.	..	..	810	..	+110
*Reo Motor Car Co.	28¼	29	34	35	+ ¼
*Reo Motor Truck Co.	11	12	26¾	..	..
Studebaker Corp. com	48	50	139	142	— 2¾
Studebaker Corp. pfd	93	95	111	..	..

INACTIVE STOCKS

*Atlas Drop Forge Co.	25	..	..	40	..
Kelsey Wheel Co.	195	..	320	365	—152½
*W. K. Prudden Co.	18¾	20½	29	33	..
Regal Motor Car Co. pfd	..	25	13	..	..

*Par value $10. †Ex-dividend.

Balk Gasoline Probe Resolution

Senate Holds Up Vote Till Trade Commission Report Is Made

WASHINGTON, D. C., April 1—After a hot debate the Senate this week failed to put the Martine resolution, directing an investigation of the high price of gasoline by the Attorney General, through its final parliamentary stage, and therefore the resolution is expected to come up again. The Senate adopted the resolution, but the preamble, asserting that the Standard Oil Co. was a trust and was responsible as such for the price of gasoline, was not voted upon finally. Until the preamble is acted on or amended and adopted the resolution is not complete, especially as the body of the resolution does not mention "gasoline" at all but merely refers to it as an article.

Senator Martine has announced that he will call up his resolution again at the earliest opportunity, but the impression prevails that he will not be able to get any action before the report of the Federal Trade Commission on the gasoline and oil subject is sent to Congress. The report is rapidly nearing completion, and probably will be sent to Congress on or about April 5.

40 Cents in Two Months?

The gasoline subject was also up in the House this week, when Congressman Howard of Georgia, in introducing a resolution authorizing the President to declare an embargo on the exportation of gasoline, startled the House with the prediction that gasoline for the use of the Government itself in huge quantities will reach a wholesale price of 40 cents in the next two months. The Howard resolution was written after the author had a talk with Secretary of Commerce Redfield, who presented some startling facts. At the same time Congressman Steenerson of Minnesota introduced a bill to give the Federal Trade Commission the power to fix prices on gasoline and allied products. It is doubtful if any action will be taken on the Steenerson bill.

"I was told by Secretary Redfield," said Congressman Howard, "that the contract price for gasoline for Government consumption last year was 11 cents. Now the producers are coming here for contracts and will not listen to any suggestion less than 40 cents."

"Government investigators report that the high price of gasoline prevailing is due to artificial rather than economic means," said Congressman Steenerson, "and yet the Department of Justice says it can find no sufficient evidence to warrant prosecution under the anti-trust laws. Here, therefore, is an instance where the competitive system has failed to secure to the people reasonable prices of one of the prime necessities of life, and we must either submit to exploitation by monopoly prices or have prices fixed by authority of Congress. That Congress has the power cannot be questioned.

"In the Federal Trade Commission we have already an instrument suited to the work. Its members have already investigated the subject, and say they can determine to a fraction of a cent per gallon just what it costs to produce and deliver this commodity in any part of the country where it is now dealt in."

Rittman Resigns—To Head New Gasoline Concern

PITTSBURGH, PA., April 1.—Dr. Walter F. Rittman, chemical engineer of the Bureau of Mines and inventor of the new process for obtaining a much greater yield of gasoline from crude oil, has resigned his position with the Bureau to become head of a company being organized for the purpose of manufacturing gasoline. It is stated that the local automobile dealers' association has been negotiating with Dr. Rittman in regard to a plan to reduce present gasoline prices. It is thought that Dr. Rittman and his company will figure in the plan.

$4,000,000 Fuel Co. Formed

DOVER, DEL., April 5—The People's Engine Products Co., with a capital of $4,000,000, was formed here yesterday to manufacture, produce and refine, buy, sell and handle petroleum, gasoline, gas and lubricating oils. The incorporators are H. E. Footh of Pittsburgh, H. C. Swann of Bellevue, Pa., and R. Robbins of Crafton, Pa.

Thielens a Studebaker Director

NEW YORK CITY, April 5—Sales of the Studebaker Corp. for the quarter ended March showed an increase of 100 per cent over those for the corresponding period of a year ago. The production is being maintained.

At the annual meeting of the stockholders the retiring directors were reelected. At the directors' meeting for organization, following the annual meeting of the stockholders, A. B. Thielens was elected a director, succeeding D. M. F. Weeks, resigned.

Hale Joins Haynes Stellite

ELKHART, IND., April 1—P. P. Hale has resigned his position as chief draftsman of the Sun Motor Car Co., this city, to accept a position in the sales organization of the Haynes Stellite Co., Kokomo, Ind.

Boycott Standard Oil Co.

Pittsburgh and Minneapolis Dealers Make New Move for Cheaper Gasoline

NEW YORK CITY, April 1—Agitation from different sections of the country for a Federal investigation of the inflated prices of gasoline is becoming more acute as each day passes.

The Pittsburgh Automobile Dealers' Assn. has agreed to buy no more gasoline from the Standard Oil Co. until its prices are justified. The association is overlooking nothing in its campaign for a substantial reduction in gasoline prices. Every buyer of a car in that city will be asked to refrain from buying from the Standard Oil Co. until prices come down to normal basis.

Federal investigation has been asked of Congress by the Minneapolis city council. The council asks for a consideration of the alleged control by the Standard Oil Co. of crude oil production and for an embargo on shipments of oil to warring nations. The situation in fact has become so acute in that city, that the Standard Oil Co. has practically been asked not to open any more filling stations in that city until it has cleared itself of all insinuations and charges as to monopoly and price manipulation.

A similar investigation has been asked by the Ohio State Automobile Assn. in Akron. This faction too believes that an embargo on exportation would relieve the situation.

In Detroit, a sort of provisional organization to discuss ways and means of combating the present gasoline situation has been formed by six representatives of automobile factories in that city, six dealers selling cars, and six garagemen. A resolution was passed asking the National Automobile Chamber of Commerce to push whatever measures are deemed necessary to relieve the situation by congressional action, embargo or other means.

Cleveland S. A. E. Meetings

CLEVELAND, OHIO, April 3—Secretary C. S. Pelton of the Cleveland Section of the S. A. E. has called the attention of members of the engineers' organization to the dates of meetings arranged by the Cleveland Section. Meetings will be held April 21, May 19, and a field day some time during June.

Motor Fuels Co. Formed

ST. JOSEPH, MO., March 31—Motor Fuels Co., capital stock $100,000; to exploit refining patents held by S. M. Herber; incorporators, S. M. Herber, J. C. Sanders, J. L. McQueen, William Taylor and Mabel Morgan.

Tire Cos. Winners In Monopoly Suit

Automobile Co-Operative Assn. of America Loses—Asks for New Trial

CLEVELAND, OHIO, April 1—The jury in the Federal District Court returned a verdict for the defendants yesterday in the case of the Automobile Co-Operative Association of America against the B. F. Goodrich Co. of Akron, B. F. Goodrich Co. of New York, the Diamond Rubber Co. of Akron and the Republic Rubber Co. of Youngstown, Ohio. The original petition included the Firestone Tire & Rubber Co. and the United States Rubber Co., but they were dismissed before the trial began.

In each case the petition was directed against the officers of the companies personally, as well as the companies themselves.

Defendants were charged in the petition with having formed and operated a combination in restraint of interstate and foreign trade and plaintiff claims that through this alleged combination its own business was destroyed and it lost the $75,000 capital with which it began business.

These companies, it was alleged, sold tires and other rubber goods and allowed a discount, usually from the retail price, which went as a profit to the dealer, but shortly after the plaintiff began business, it was charged, this combination was formed and prices were fixed arbitrarily, thus excluding the plaintiff and others from buying and selling freely and obtaining automobile accessories.

The petition charged that dealers were sent communications which frightened them and prevented them from buying goods of other companies and that defendants refused to sell to any one who furnished goods to plaintiff at wholesale prices. It was also alleged that blacklists, containing plaintiff's name, were distributed and that an agreement existed between defendants and an association of retail dealers in New York City by which the dealers were prevented from selling anything to plaintiff.

In addition to the alleged loss of its capital, plaintiff alleged that its profits, estimated at $50,000 annually, had also been lost. It asked judgment threefold the damages adjudged, and other sums that would have brought the entire amount up to $450,000.

The Automobile Co-operative Association has filed a motion for a new trial.

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Receivers for Mason-Seaman Taxicab

NEW YORK CITY, April 1—The Mason-Seaman Transportation Co., one of the largest taxicab companies in this city, was placed in the hands of receivers yesterday. Lower taxicab rates and the present high cost of gasoline figured prominently in the reasons given for the failure of the company.

The company is capitalized at $10,000,000 and was organized in 1914 to take over the Mason-Seaman Transportation Co. and the Yellow Taxicab Co.

The company has 1000 touring cars and taxicabs on hand. The value of the assets is not given, but the liabilities are set down as $400,000.

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Metric System Bill Provides $500 Fine or Jail

WASHINGTON, D. C., April 1—A bill for the compulsory use of the metric system has been introduced in Congress. According to the bill, after July 1, 1924, all Americans may have the choice of breaking the law or of using the metric system; any person, corporation, company, society, or association who shall use, or offer and attempt to use, in any industrial or commercial transaction in the sale or purchase of any commodity any other weights and measures than those of the metric system shall be guilty of a misdemeanor, and upon conviction thereof in any court shall be punished by a fine of not more than $500 or by imprisonment for not more than three months, or by both such fine and imprisonment. Frederick A. Halsey, who led the fight against the metric system a decade ago, is again leading the opposition to the measure, which is known as the Dillon bill.

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58,502 Cars Bought in Ohio in 1915

COLUMBUS, OHIO, April 1—Statistics prepared by Fred H. Caley, secretary of the Cleveland Automobile Club, and submitted at the annual meeting of the Ohio Automobile Association showed that the State of Ohio purchased 58,502 cars during 1915, which was the largest number sold in any State in the union. According to the statistics New York was second with 56,671 cars; Illinois third, with 51,150 cars; Pennsylvania fourth, with 43,588 cars, and California next, with 40,700 cars. Basing the figures on the 1916 U. S. census estimate, there is now one car to each twenty-eight people in the Buckeye State.

According to a report made by W. H. Walker, Ohio registrar of automobiles, covering the present year up to and including March 28, the department has issued 121,000 sets of licenses to gasoline automobile owners in the State since the first of the year. It was late in May last year when that number was reached. Up to date the department has issued 2361 licenses to dealers and 7981 licenses to owners of electric cars.

Bay State Regulates Lighting

All Vehicles Must Light Lamps at Same Time—Other Measures

BOSTON, MASS., April 3—Governor McCall has signed two of the bills of interest to automobilists that have reached him. One of these provides that all vehicles shall display their lights half an hour after sunset and half an hour before sunrise. The law compelled the motorists to light up at those times, but the owners of other vehicles did not have to light their vehicles until one hour after sunset, so the new law makes the time uniform for all vehicles.

Another measure signed allows an automobilist in an adjoining State who lives within 15 miles of the border to register his car in the Bay State for a fee of $2. This is the law in New Hampshire and Maine, and allows business men to run back and forth without having to pay a yearly registration in both States.

The bill to allow the sale of gasoline and to make repairs on Sunday went through all the branches. Then it was killed in the Senate, but reconsideration was granted, and it is still in abeyance. A bill to compel all motorists to take out a $2,000 bond before driving their cars was killed, and the bills to compel all owners to pass a physical and mental test, and the other to take the discretionary powers from the Highways Commission were also killed, but not until they had reached close to the enactment stage.

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Wisconsin Registrations Gain 70 per Cent

MILWAUKEE, WIS., April 1—A total registration of 51,000 cars by private owners at the close of business March 31 is the unprecedented record of the State of Wisconsin. A year ago the total registry for the first quarter of 1915 was slightly under 30,000, showing a gain of 21,000, or 70 per cent. Although the Department of State planned only on a registration of 100,000 for 1916, predictions are freely made that the number will run up to 115,000 before the end of the year.

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Must Stop, Look and Listen at R. R. Crossing

LANSING, MICH., March 30—That an automobile driver when about to cross a railroad must stop, look and listen in such a way and at such a distance from the crossing that it really can be shown that he took all necessary precautions, is a decision of the Supreme Court of Michigan, in the case of J. S. Sanford of

Battle Creek against the Grand Trunk Railroad.

In his opinion, Judge Brooke states, "The duty of an automobile driver approaching tracks where there is restricted vision, to stop, look and listen, and to do so at a time and place where stopping, and where looking and listening will be effective, is a positive duty and the safeguarding steps the plaintiff failed to take. He stopped where stopping served no purpose, and failed to stop where stopping would have disclosed danger. He made chance and not sight, the guarantee of his safety."

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Collins Curtain Maker Wins in Patent Suit Appeal

DETROIT, MICH., March 31—The award of $20,000 damages to W. A. Paul as a result of his suit against J. N. Collins, J. A. Bennett and the Novelty Leather Works, maker of Collins Curtains, claiming invention on a curtain holder for inside curtains on automobiles, has been set aside by the Supreme Court of Michigan, which has reversed the decision of the Wayne County circuit court on Jan. 22, 1915.

The patent involved was No. 1,066,448, filed by Collins July 22, 1912, and granted to him July 1, 1913. The attorneys for Collins, Bennett and the Novelty Leather Works appealed the case, claiming that the circuit court had no jurisdiction in the matter and that the case should have been heard in the Federal courts.

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Troy Trailers for U. S. Army

TROY, N. Y., April 1—The United States Government bought eleven 2½-ton Troy trailers for use in the punitive expedition against Villa in Mexico on March 21. These trailers were shipped by a special train which made passenger train time on the trip to El Paso, Tex.

There was not time enough to give the finishing touches in the factory and a squad of painters was sent along to give the trailers the second coat and striping on the run.

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Garagemen Liable for Employees

COLUMBUS, OHIO, March 31—In a decision handed down by Judge Ruth in the Municipal Court owners of garages are held responsible for the acts of their employees, for automobiles left in their care. William K. Krauss sued Albert B. Brightman for damages done to his car while stored in Brightman's garage when an employee drove it and sustained an accident.

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No Cars—No Show

ATLANTA, GA., March 28—There was to be an automobile show here, but the dealers have sold all their cars and have none to exhibit.

Prosperity in Northwest

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$40,000,000 in Deposits—Brisk Spring Trade Expected—Crop Conditions Good

NEW YORK CITY, April 3—Prosperity is shown in the reports from the Federal Reserve banks in the twelve regional districts. Business is flourishing despite the freight embargo and the growing cost of production. There is much activity in all retail lines and orders are overwhelming the manufacturers.

Excellent business conditions are reported from the Northwest. The public there seems to be guided by a spirit of common sense in its purchasing. Money is not being spent to an unwarranted degree for luxuries, although the better classes of goods are in demand. To a large degree the individual buyer is trying to get his money's worth—he has good purchasing power and is willing to spend his money.

Savings deposits in banks in the Northwest continue to increase and the spirit of thrift is becoming more evident. A new high record for deposits in Minneapolis is shown in the last comptroller's call for a statement from national banks. Present figures are slightly in excess of those of December, 1915, and illustrate a growth in deposits of nearly $40,000,000 since the March call of 1915. Loans and discounts for Minneapolis banks show a substantial increase over the December figures and a still greater increase over those of March a year ago.

Horses Slow Up Business

Roads in the country have been, in many cases, almost impassable for the last three weeks. In these days a very large percentage of country travel is by automobile, and when the breaking up of winter makes the roads bad for heavy motor transportation and the farmers have to depend upon horse-drawn vehicles, there is a very marked slowing up of business.

Every prospect is for brisk spring trade as soon as the roads are passable.

Reports from the territory to the south and west of that territory indicate good prospects for the coming crop. In the winter wheat belt the fields are apparently in good condition with plenty of moisture, although a recent storm will probably delay spring operations to some extent. Reports come from Iowa of general optimism and to some extent increased value for farm land, with some activity in the land market.

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Large Sales Predicted for Norway

NEW YORK CITY, March 31—Prosperous conditions as a result of the European war will create a new outlet for American automobiles in Norway. V. E. Lindzen, of Lindzen & Robsahm, Christiania Hupmobile distributors, upon arriving in Detroit, stated that business in that country is better than ever before. Up to the start of the war most of the cars sold in that country were of German makes with a few Minervas from Belgium, Renaults from France and Daimlers from England. As these machines cannot now be secured, the dealers will naturally turn to the United States for their cars.

There are probably 2000 cars in Norway at present, and a large increase is expected in the near future.

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Automobile Service Managers Want N. A. C. C. Help

DETROIT, MICH., April 4—Thirty members of the Automobile Service Managers' Assn. of Mich. were present at a smoker given by the organization at Hotel Statler on April 1. General service matters were discussed and it was the feeling that the service men must have the co-operation and help of the National Automobile Chamber of Commerce in promoting a standard service policy such as has been suggested by the association. Another meeting of the service men will be held on April 11 at the same place, at which a standard repair parts policy will be discussed and acted upon. This will then be referred to the National Chamber with the hope that the latter organization will get behind it and seek to have it generally adopted. It is the general feeling that the meetings should be better attended and that all manufacturers should co-operate and take an interest in the work.

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Edison Sales Organizations Meet

ORANGE, N. J., April 5—Salesmen and branch managers of the Edison Storage Battery Co. gathered at the factory and main office, Orange, recently for the annual sales meeting. H. G. Thompson, vice-president and general sales manager, presided. Those in attendance included: John Kelly, New York; W. F. Bauer, L. F. Meissner, H. J. Butler, Chicago; Bertram Smith, G. F. Simon, Detroit; E. M. Cutting, San Francisco; George W. Holden, Boston; C. H. Clare, New York; Geo. Drake Smith, E. J. Ross, Jr., H. H. Smith, F. V. McGinness, H. M. Roberts, H. W. Stortz, John Pulster, J. B. Renwick, Jr., R. C. Veale, A. Mudd, Geo. J. Glaser and Paul Sutcliffe, Orange.

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Tire Shortage in Sweden

NEW YORK CITY, March 31—The automobile business at Sweden has been brought to a standstill by the war, according to Willy Schroeder, a representative of a Swedish tire company. Owners of cars stuff old tires with rags.

Factory Miscellany

Champion Ignition Adds—The Champion Ignition Co., Flint, Mich., has announced that work will be begun soon on a modern fireproof addition to its factory, which will add 12,500 ft. of floor space to the plant.

To Make Non-Skid Devices—T. O. Nelson of Fort Wayne, Ind., has gone to Goshen, Va., where he will make arrangements for the opening of a factory for the manufacture of automobile non-skidding devices and a new type of farm implement. The Virginia town has offered unusual inducements to obtain the factory.

Making Hearse Bodies—J. W. Henney, Jr., Freeport, has leased the Bloom Bldg., Hancock Avenue, East Freeport, and commenced the manufacture of hearse bodies for automobiles. He has for his associates several Chicago men who are well versed in body making for motors. Mr. Henney recently resigned his position with the Staver Auto Mfg. Co., Chicago, to take charge of the Freeport plant. He was for many years superintendent of the Henney branch of the Moline Plow Co. The new plant opened for business April 1.

Gardner Machine to Add—The Gardner Machine Co., Beloit, Wis., has awarded contracts for the erection of a 100 by 100 ft. machine shop addition and a new power house, 40 by 60 ft. The capacity will practically be doubled. The company has been working night and day for many months, and the addition will be rushed to give much-needed relief. The Berlin Machine Works, also of Beloit, which recently changed its name to P. B. Yates Machine Co., has awarded contracts for a new shop, 285 by 263 ft. The Yates company specializes in machinery for woodworking.

Inglis Succeeds Wallman—The Wallman Manufacturing Co., manufacturer of gasoline and oil storage systems, tanks and pumps, 283 Fifth Avenue, Milwaukee, Wis., has been succeeded by the Inglis Mfg. Co., a newly organized concern of which C. W. Inglis of the Milwaukee Steel Foundry Company is president and treasurer, and Charles Inglis, for 28 years past with the International Harvester Co., Milwaukee branch, is secretary and manager. It is the intention of the new concern to improve and largely increase the production of garage systems.

Gillette Safety Tire to Build—The Gillette Safety Tire Co., Eau Claire, Wis., has awarded contracts for the erection of its new factory, foundations for which were laid during the winter. The company was organized last fall by R. B. Gillette, an Eastern tire expert, and is spending about $75,000 in factory building and equipment. The main factory will be 60 by 250 ft. Work will begin at once and it is hoped to be able to start actual production by July 1.

To Invade Automobile Field—The Pulley-Grip Co., 405 Broadway, Milwaukee, Wis., which has been marketing a chemical compound for application to pulleys in factories and workshops to minimize belt slippage, is now putting out the preparation in a small size for use on fan and motor pulleys on pleasure and commercial cars. It is claimed that the use of Pulley-Grip will not only keep the fanbelt from slipping, but preserves the belt and saves bearings. The article is being used widely in all parts of the country by the largest manufacturers. It is stated that several truck and motor builders are equipping all belt-driven mechanisms with Pulley-Grip as standard equipment as a preventive of overheating on heavy-duty motors especially.

The Automobile Calendar

April 1-8.....Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.

April 3-8.....Twin Falls, Idaho, Show, Oliver Tabernacle, B. H. Fuller, Mgr.

April 8.....Corona, Cal., 300-Mile Boulevard Race, Citrus Belt Racing Assn.

April 10-15.....Seattle, Wash., Show, Arena.

April 10-15.....Danville, Ill., Eastern Ill. Automobile and Electric Show; Chambers Bldg.

April 11-13.....Milwaukee, Wis., Spring Show; Dealers' Show Room Automobile Display; Milwaukee Automobile Dealers.

April 12-15.....Champaign, Ill., Show, Gymnasium Bldg., University, Ill.

April 14-16.....Milwaukee, Wis., Garage-Circuit Exposition, Milwaukee Automobile Dealers.

April 15.....Altoona, Pa., Pennsylvania State Motor Federation.

April 26-May 6...Oakland, Cal., First Annual Pacific Coast Motor Power and Automobile Show, Automobile Industries Assn.

May 6.....Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.

May 9-12.....Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead.

May 13.....New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.

May 14-20.....Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.

May 20.....Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.

May 26-27.....Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.

May 30.....Des Moines, Ia., Iowa Derby, 20 Miles; Des Moines Special, 10 Miles.

May 30.....Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.

May 30.....Indianapolis Speedway 300-Mile Race.

May 30.....Minneapolis, Minn., Speedway Race.

June 10.....Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.

June 12-16.....S. A. E. Summer Trip on Great Lakes.

June 20.....Galesburg, Ill., Track Race, 100 miles.

June 28.....Des Moines, Iowa, Speedway Free-for-all, 300-mile race.

July 2-6.....Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.

July 4.....Coeur d'Alene, Idaho, Race Meet, Hilles-Riegel.

July 4.....Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.

July 4.....Minneapolis 300-Mile Speedway Race.

July 4.....Sioux City Speedway Race.

July 15.....Omaha, Neb., Speedway Race.

July 15.....North Yakima, Wash., Track Race, Riegel-Hiller Co.

Aug. 5.....Tacoma Speedway Race, Tacoma Speedway Assn.

Aug. 11-12.....Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.

Aug. 12.....Portland, Ore., Track Race, Riegel-Hiller Co.

Aug. 18-19.....Elgin Road Race.

Sept. 4.....Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4.....Indianapolis Speedway Race.

Sept. 4-5.....Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 11-16.....Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

Sept. 16.....Providence Speedway Race.

Sept. 29.....Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30.....New York City, Sheepshead Bay Speedway Race.

Oct. 7.....Philadelphia Speedway Race.

Oct. 7.....Omaha Speedway Race.

Oct. 14.....Chicago Speedway Race.

Oct. 19.....Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Nov.....Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

The Week in the Industry

Boston Trade News—A. F. Chandler has been placed in charge of the retail sales for the Jackson Motor Co. of New England. He was formerly with the Willys-Overland and Paige-Detroit factories as traveling salesman, and later with the Becker Stutz Co. at Boston.

A. H. McIntyre, formerly with the Jackson company, is now with the wholesale department of the Saxon Motor Co.

Williamson Joins F. W. D.—G. H. Williamson of Cincinnati, formerly associated with the Maxwell Motor Co., Detroit, as district manager, has accepted a position in the sales department of the Four Wheel Drive Auto Co., Clintonville, Wis.

Milwaukee Items—The Wait Automobile Co., Fourth and Prairie Streets, Milwaukee, Wis., State distributer of Moline-Knight cars, has moved to new and larger quarters at 789-791 Thirty-second Street, and is occupying a modern, fireproof garage building, with ample repair-shop facilities.

John Wisniewski & Son, 904 Kinnickinnic Avenue, Milwaukee, have been appointed district agents for the Farmack Motor Co., Chicago, for Milwaukee and vicinity.

F. J. Siekert & Co., 326 Wells Street, Milwaukee, have been appointed agents for the Olsen wheel for Ford trucks and representatives of two large builders of delivery bodies for Ford chassis.

Washington Items—G. W. Miller, automobile dealer in Seattle, will shortly close out his stock of used cars at 715 East Pine Street, and following the trend of the times, will engage in the used parts business on East Pike Street.

Sharp and Leader of the Puget Sound Auto Co., Seattle, are now distributors of the Cole car in western Washington, which they will handle in addition to the Reo.

Another tire has made its appearance in Seattle, the Mohawk, distributed in Washington and Oregon by the Pacific Auto Supply Co. C. E. Barteau is president of the company in Seattle.

R. V. Barnett, field manager of the service department of the Mitchell-Lewis Motor Co., paid his annual visit to the Pacific Coast during the past month, visiting the Mitchell branches in California, Oregon and Washington. Reviewing the business, he said: "Conditions on the Pacific Coast, especially in the Northwest, were never better. Our sales to date are more than 100 per cent greater than last year."

Trade Happenings

Hartford Trade Changes—The A. C. Hine Co., Hartford, Conn., distributor in this State for Oakland, has put in an accessory department, giving up one-half of the salesroom at 314-316 Pearl Street for the purpose. W. J. Rabbitt, formerly with the Post & Lester Co., has been placed in charge. The Hine company has taken on the Knight tire for the State.

A deal is now in the works for the acquisition by the Willys-Overland Co. of a plot of ground at the corner of Asylum and Hurlburt Streets, Hartford, 90 by 140 ft., approximately. It is understood in automobile circles that the site will be used for a three-story service station and salesroom for Overland cars.

Andrew Caskey, at 26 Mechanic Street, Hartford, has taken on the Rayfield carburetor, formerly handled by the Palace Auto Service Co.

R. R. Ashwell, in the Ashwell service building, 341 Trumbull Street, has taken on the Norma ball-bearing and the Atwater Kent system of ignition.

Baltimore Trade Items—The Rawlings Implement Co., 11 West Pratt Street, Baltimore, Md., has taken over the distribution of the Federal tire.

The Mohawk Tire Sales Co., 1201 North Charles Street, Baltimore, has succeeded the Motor Car Accessory Co., and has taken over the stock, fixtures and good-will of the company. Mohawk tires will be a feature of the company's business. C. M. Ness of the firm of Charles M. Ness & Co., horse saddlery dealers, is president of the company, and G. T. Ness, vice-president. Frank Rowe is in charge of the sales and general management of the new company. Lerch Bros., Inc., 110 Hanover Street, Baltimore, has taken over the agency of the McGraw tires, a new line to Baltimore, and the firm will also distribute the McGraw product throughout the State.

H. C. Clark, 1014 Morton Street, Baltimore, has located at that address following the dissolution of the Motor Car Accessory Co. Several accessories, including Master Carburetor and Safety Vulcanizer, will be distributed throughout the State.

The United Auto Sales Co., a concern backed by several of Baltimore's leading men, has taken over the business of F. B. Donovan, Inc., and will handle the Studebaker line. The company will continue to maintain its office and showrooms in the Colonial Motor Car Bldg., 10 to 20 East North Avenue, and the service station will remain under their charge on Biddle Street, near Eutaw. Besides looking after Baltimore City, the new company will cover the territory in Baltimore, Harford, Howard, Anne Arundel and St. Mary's counties. Officers are: T. E. Straus, president; H. A. Mayer, vice-president and general manager, and W. E. Straus, secretary-treasurer.

Illinois News Items—A. Eisele, Rock Island, Ill., has purchased the stock of J. H. Bolte in the Union Motor Co., and will add a repair shop to the plant. He will be distributor of the Chevrolet car in Rock Island and adjoining counties.

The Modern Power Appliance Co., Rockford, Ill., was incorporated this week; capital stock, $5,000; incorporators, S. G. Smith, H. H. Rogers and W. D. Knight. Object, to manufacture and deal in automobiles, storage batteries and other supplies. A plant has been opened on North Main Street.

The Auto Starter Co., 168-172 North Halstead Street, Chicago, has been incorporated; capital stock, $2,500; incorporators, W. F. Millar, J. W. Diephouse and R. B. McKinney, to manufacture and deal in starters and other supplies for motor vehicles.

D. A. Heald and R. A. Snider, for a number of years mechanics with the Fisher & Raker garage, Canton, Ill., have decided to engage in business for themselves and have opened a new garage at 244 Van Buren Street, that city. They will carry a line of supplies and accessories in addition to a general repair business and battery and generator work.

Spokane, Wash., and Vicinity—The Foster-Larson Co., distributor for the Paige line in eastern Washington, has enjoyed an active business month during March. Jones and Smith closed for the agency for the Paige at Coulee City, Wash.; L. C. Densow took over the Paige agency at Krupp, Wash., and to the Enterprise Garage at Wilbur, Wash., went another Paige agency. The Ephrata Garage contracted for the same line at Ephrata, Wash.

Quaker tires have been introduced in Spokane by the McGowan Hardware Co., who have taken the agency for this line of tires for Spokane and the Inland Empire.

R. L. Strickle has been appointed secretary and treasurer of the Spokane Oldsmobile agency. Mr. Strickle was formerly of Winnipeg.